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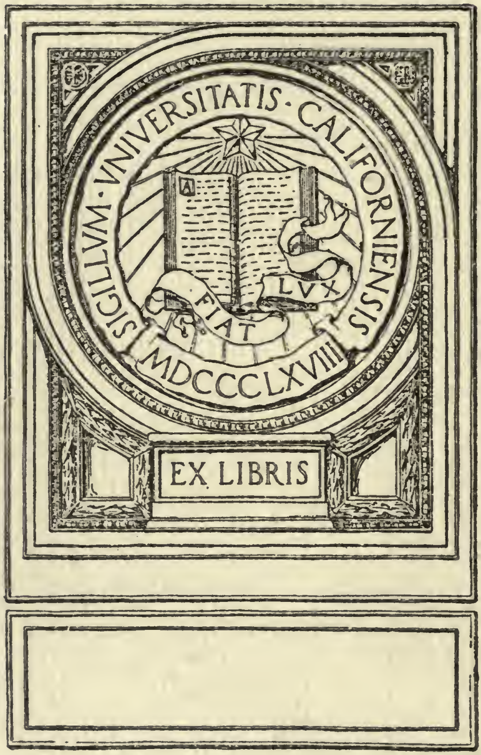

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Opportunities for Handicapped Men in the Rubber Industry

By Bert J. Morris and Charles H. Paull
Bureau of Vocational Guidance
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Harvard University

Prepared by the
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UNIVERSITY OF CALIFORNIA

The Red Cross Institute for Crippled and Disabled Men
311 Fourth Avenue New York City

Opportunities for Handicapped Men in the Rubber Industry

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Courtesy, Boston Rubber Shoe Co.

A one-armed man in the machine repair shop of a rubber factory

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Foreword

A FAIR trial of handicapped labor necessitates a right attitude on the part of both the employer and the employee at the start. While the purpose is to put the men in places where they will be fully efficient, attempts to so place them will be futile unless employers, superintendents, foremen, and fellow workers are patient with the handicapped men until they become thoroughly adjusted to the new conditions. Even though a disabled person is carefully trained and well-equipped to do certain work, it will, as a rule, take some time for him to reach his highest efficiency. Until that time, at least, he will need encouragement from all with whom he is associated.

The Use of Appliances by Injured Men. In order to simplify the discussion of disabilities in connection with the various operations in the rubber industry, it has been assumed in each case that where a member has been lost a suitable appliance will take its place. It is not within the scope of this discussion to speak in detail of the possible appliances. However, where there has been any doubt as to obtaining a desirable appliance in connection with any operation, this particular operation has not been recommended. It will, therefore, be assumed that where a man has lost a leg, an artificial limb will take its place. The character of the artificial member will, of course, depend on the sort of work which will be done. The same rule will hold for loss of hands or arms.

The Problem of Wages. In cases where wages are mentioned, they represent as nearly as possible those wages which were being paid at the time of the writing of this article. These figures are, therefore, somewhat limited in their value, and employers refrain from making an estimate of what wages may be after the war ends. Perhaps the only value of studying the wages lies in a comparison of wages paid in various operations. The general relations here would probably remain about the same should there be a change in the scale. Another factor in connection with wages as they are stated is that they apply at the present time to able-bodied men. As nearly as possible, this investigation recommends men for operations only when it seems probable that they will be able, in the course of time, to perform them with a reasonable amount of efficiency. On the other hand, it must be borne in mind that these men will have to acquire dexterity in using their artificial appliances. Their ability, then, to reach the maximum of usefulness will depend on (1) the seriousness of their injury; (2) whether this injury is combined with other injuries; (3) their native dexterity in motion and manipulation; (4) the amount of training they have had since the loss of their members; (5) the willingness of the shop foremen and fellow workers to give them special assistance; (6) the general attitude of mind of the individual as determined by home and social environment.

The Time Required to Learn Specific Operations. Considering these various factors, it becomes apparent that the length of time for training in various operations will vary considerably in different cases, so that the length of time stated for acquiring a fair knowledge of each operation must be considered as only an approximation, and disabled men must not feel discouraged if they find that it requires longer for them to learn their work than has been suggested.

In factories employing an industrial engineer, there is a marked opportunity for the re-arrangement of work for the special accommodation of disabled men. The study of such points as the placing of material, the variation of operation, and the location of machinery ought in many instances to result advantageously not only for the operator, but also for the factory.

Nationality of Workers. Instead of discussing nationalities in connection with the several operations, it seems more desirable to make a brief statement in the introduction. Rubber plants at present employ a great variety of nationalities in their various departments. Important among these are American, Italian, Polish, Austrian, Russian, Armenian, French Canadians, Lithuanians, Greeks, and Germans. Since the beginning of the war some factories have introduced negro labor. Different nationalities predominate in different factories, although American, Italian, Lithuanians, and Polish workmen form the majority in most instances. In very few departments are all the men Americans, though there seems to be a tendency for the Americans to take the lighter operations. In the heavier work in the mills there is a divergence of preference of foremen for various nationalities. Some plants speak highly of their Polish mill hands, while others favor Americans or Italians.

The following statistics covering a number of footwear factories show how wide is the distribution of nationalities in the rubber industry:

1. Number of employees:

Male	9,800
Female	9,000
Total	18,800

2. Per cent. of Various Nationalities in Factories:

Americans	50%	Poles	6 %
Armenians	1	Portuguese	3
Austrians	2	Russians	5
Canadians	4	Scandinavians	3

Finn	1%	Turks	.5%
French	.5	Miscellaneous	.7
Germans	2	Swiss	.1
English	3	Syrians	.1
Greek	1	Hebrew	.1
Irish	6		
Italians	8		
Lithuanians	3		

3. Per cent. of Foreign Nationalities in Departments:

Mill	15%
Cutting	33
Making	45
Shipping	33⅓

Opportunities for Handicapped Men in the Rubber Industry

The rubber industry offers a variety of occupations in which handicapped men may find profitable employment. Especially is this true in regard to unskilled and semi-skilled workmen. Although certain features of the work, such as long hours, heavy lifting, and continuous standing are disadvantages not to be overlooked, the industry on the whole possesses most of the characteristics generally considered of first importance in selecting desirable occupations for disabled soldiers and sailors. These important characteristics are: Substantial growth, increasing demand for workers, steady employment, essential products, and a high standard of wages in proportion to the length of time required to learn the operations. These features assure the worker of continuous, steady, satisfactory employment at reasonable wages—the very things that mean most to handicapped men.

The Growth of the Industry. The industry has had a substantial growth for several decades past. For a few years previous to 1909 there was a noticeable decrease in the output of certain articles but this was only temporary, and for the last six or seven years the industry has been developing rapidly along all lines. As no rubber is produced in the United States, the amount of crude rubber imported is an accurate gauge of the growth of the industry. In 1907, the imports amounted to 63,006,352 pounds, while, in 1917, the amount was 341,537,322 pounds; an increase of over 442 per cent. in ten years. The same story is told by the value of manufactured articles exported. During the decade from 1899 to 1909 the value of the exports of rubber boots and shoes increased 21 per cent.; of mechanical goods 259 per cent.; of sporting goods 204.6 per cent.; and of dentists' materials 191.2 per cent. The value of the total annual output, likewise, shows the same growth. In 1909 the value of all products was $224,373,321 while in 1917 the value was $895,816,248; an increase of almost 300 per cent. When we turn to the number of employees and the amount paid in wage earnings, the same substantial growth is evident. The increase in the wages paid in 1909 over the amount paid in 1899 for the manufacture of boots and shoes was 22.4 per cent.; for mechanical goods 212 per cent.; for sporting goods 138.1 per cent.; and for dentists' materials 54.7 per cent. The number of wage earners increased from 57,346 in 1909 to more than 240,000 in 1917; an increase of over 300 per cent.

The Scope and Future Development of the Industry. There are, all together, more than 50,000 articles made of rubber. When the industry was first established, the output was confined almost entirely to waterproof clothing but, after chemists discovered how to compound various ingredients with rubber and by that means produce a material readily molded into any desired shape, the industry rapidly expanded so as to include many other lines of manufacture. The field is so large today that the work has naturally been subdivided into a number of distinct branches. In addition to rubber footwear and surface goods, the most important of these are the manufacture of mechanical goods, such as hose, belting, cables, valves, insulating compounds, gaskets and tubings; hard rubber goods, such as battery jars, electric supplies, combs and fountain pens; medical goods, such as dentists' sundries, hospital sheeting, bandages, blankets, bottles, gloves, and surgeons' equipment; sporting goods, such as footballs, striking balls, and tennis balls; pneumatic tires and tubes and solid tires for carriages and motor vehicles. Since the outbreak of the war, two other important divisions of rubber manufacture have developed. One is aircraft equipments, including rubberized fabrics for balloons, airplanes, and parachutes. The other has to do with materials used in gas defense, such as gas-proof cloth and various molded parts necessary for making masks.

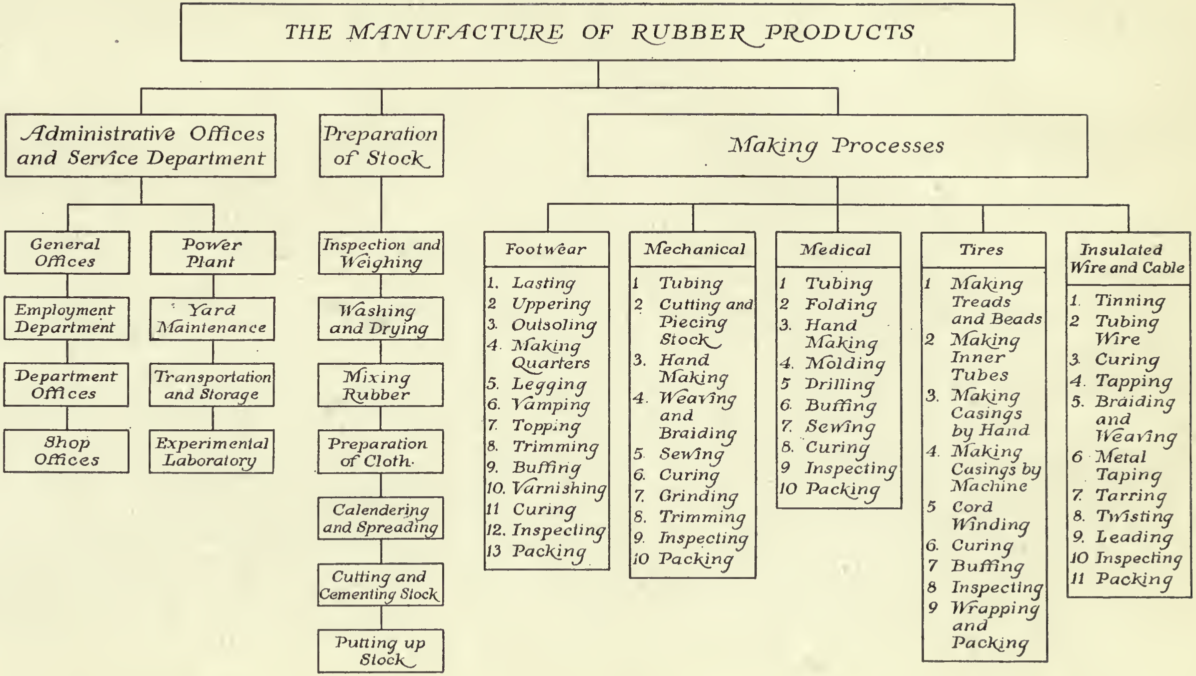
The future development of the industry is practically unlimited and depends upon new discoveries in the chemical laboratories. "In the light of past developments," to quote an authority on rubber manufacture, "it is not such a long stretch to the time when the rubber tire will meet a rubber pavement and the rubber sole will walk on a rubber sidewalk. This time, in fact, is nearer than we think. Experiments in rubber pavement have now been carried on for twenty years and they have proven satisfactory from a practical standpoint. Cost is the only barrier at the present time—and the price of rubber is going down while the price of other materials is going up." Other leading men in the industry say that we may look for the application of rubber to the manufacture of furniture, flooring, roofing, and many other parts of buildings for which wood is now being used. Developments of this kind would only be in line with what has already taken place in Europe. While the rubber industry has reached enormous proportions, it is still in its infancy, and it is not unreasonable to expect that the growth will be more rapid in the coming years than it has been in the past.

The Source of Rubber. Rubber is obtained from the milk or latex of a variety of trees which are native to Central and South America, but which thrive under cultivation in practically all tropical regions. The latex is not the sap of the tree, but a substance which forms between the outer and inner layers of the bark. It develops so rapidly that trees can be tapped every day for a period of nine or ten months during the year. Though the latex resembles milk in appearance, it readily breaks up on standing into a liquid and a soft, sticky, gum-like substance. For commercial purposes the liquid is evaporated by the application of smoke or various acids, leaving a product known as crude rubber.

A Modern Rubber Factory

There are at the present time in the United States more than 500 rubber manufacturing plants. They vary, of course, in size and details but have similar equipment and follow about the same procedure of work. Whether the plant is large or small, all of the preparatory processes, such as washing, drying, mixing, calendering, and cutting have to be done. This work requires expensive machinery. In order to receive a reasonable income on the immense outlay of capital, a large output of manufactured goods is necessary. For this reason, most modern plants are operated on a very large scale, employing from several hundred to several thousand workers. A typical plant is really a fair-sized community requiring plans of control and supervision in regard to sanitation, housing, and transportation as well as in carrying out the various operations inside of the plant.

The fact that the rubber industry has grown so rapidly in recent years has tended to produce modern buildings in most rubber plants. There are still to be seen a few of the older type of structure with their poorly lighted and ventilated rooms and narrow and inconvenient stairways. In the newer buildings, however, working conditions are excellent. The window space is large. Many of the rooms are finished in white paint, which adds to the light and general cheeriness of the place. As far as is possible, the



THE MANUFACTURE OF RUBBER PRODUCTS

- Administrative Offices and Service Department
  - General Offices
  - Employment Department
  - Department Offices
  - Shop Offices
  - Power Plant
  - Yard Maintenance
  - Transportation and Storage
  - Experimental Laboratory
- Preparation of Stock
  - Inspection and Weighing
  - Washing and Drying
  - Mixing Rubber
  - Preparation of Cloth
  - Calendering and Spreading
  - Cutting and Cementing Stock
  - Putting up Stock
- Making Processes
  - Footwear
    1. Lasting
    2. Uppering
    3. Outsoling
    4. Making Quarters
    5. Legging
    6. Vamping
    7. Topping
    8. Trimming
    9. Buffing
    10. Varnishing
    11. Curing
    12. Inspecting
    13. Packing
  - Mechanical
    1. Tubing
    2. Cutting and Piecing Stock
    3. Hand Making
    4. Weaving and Braiding
    5. Sewing
    6. Curing
    7. Grinding
    8. Trimming
    9. Inspecting
    10. Packing
  - Medical
    1. Tubing
    2. Folding
    3. Hand Making
    4. Molding
    5. Drilling
    6. Buffing
    7. Sewing
    8. Curing
    9. Inspecting
    10. Packing
  - Tires
    1. Making Treads and Beads
    2. Making Inner Tubes
    3. Making Casings by Hand
    4. Making Casings by Machine
    5. Cord Winding
    6. Curing
    7. Buffing
    8. Inspecting
    9. Wrapping and Packing
  - Insulated Wire and Cable
    1. Tinning
    2. Tubing Wire
    3. Curing
    4. Tapping
    5. Braiding and Weaving
    6. Metal Taping
    7. Tarring
    8. Twisting
    9. Leading
    10. Inspecting
    11. Packing

floors are kept clean. Modern fireproof stairways and sprinkler systems add to the safety of the workers. Drinking fountains are placed at convenient intervals throughout departments, and toilets are located on each floor.

Many of the newer buildings are arranged in the unit form and are usually three or four stories in height. This gives air and light space between buildings and facilitates the enlargement of the plant when desired. A number of companies have taken steps in various ways to add to the attractiveness of their buildings and grounds. Where space is available, shrubbery and trees have been planted, and lawns have been laid out.

To secure the best results in plants where large numbers are employed, a well organized administrative system is necessary. The general manager who has oversight of the entire plant must have department superintendents whose duty it is to look after specific parts of the work, such as purchasing materials, production of goods, maintenance of plant, and employment and welfare of workers.

Facing page 12 is a diagram showing the organization of a plant employing approximately 10,000 workers. Smaller plants would differ from this only in the extent of the organization. Many of the administrative functions designated in the diagram might be combined under one official, and all the preparatory processes might be done in one department. The making processes would vary with the lines of articles produced; some companies making shoes only, some mechanical goods, some medical goods, and some automobile tires.

In connection with the service department of many companies, various welfare and educational projects have been undertaken. Lunch rooms have been provided; recreational activities have been encouraged; and lectures on popular subjects have been offered at noon hours and other times. Social and athletic organizations have been formed. Some companies employ visiting nurses in connection with their health and medical work. Where a large number of non-English speaking workers are employed, various schemes for teaching English have been undertaken with varying degrees of success. All these activities have been of immeasurable value to the employer on the one hand and to the employee on the other. They have assisted in re-establishing the spirit of confidence and understanding which the rapid development of our industrial system has tended to do away with.

Some rubber companies draw their help from a considerable area, while other companies form the center of the working community. In the latter case, there is a larger community interest existing between the industry and the worker, and this affords an opportunity for the industry to take an active interest in housing schemes, assisting their employees by providing houses for rent, or loaning money for the purchase or building of houses.

As the administrative work is very similar to that of any large industry, it has not been discussed in this bulletin. The operations in connection with the preparation of the stock and the making processes are treated in detail in the following sections of the report. After each operation has been described, a brief statement is made concerning the time required to learn the work, the average wages paid at the present time, the opportunities for advancement, and the suitability of the work to various handicaps.

Provisions for Training Workers

The method of training workers followed in most plants until very recently was to start a green man at a table with an experienced worker. Fair results have, in the past, been secured in this way but several disadvantages have come to light. As the making of rubber goods is largely done by piece-work, few men have been willing to take the proper time thoroughly to instruct a beginner. If the worker does not turn out the usual amount of work, he, of course, receives less pay. This is offset partly by the fact that the work of the beginner is credited to the experienced man. For a few days and sometimes for a week or more, however, the work of the beginner does not compensate for the time lost on the part of the regular worker. Another disadvantage is that too frequently persons who are good workers are poor instructors, with the result that the best methods of making rubber goods are not taught. This is really a serious disadvantage as it manifests itself in both the amount and quality of output. Another disadvantage is that this method fails to develop uniformity in instruction, without which a high standard of quality is hard to maintain.

A Shop School. Many establishments have recognized these disadvantages and are taking steps to overcome them. The Hood Rubber Plant at Watertown, Mass., has established an apprentice school for footwear makers. All women beginners must pass through this school before taking up regular work in the factory. The school was established in April, 1917, and has grown until, at the present time, sixteen regular instructors, in addition to the superintendent, are employed. The school started in a small way. A room was set apart for the work and regular making tables were installed. One of the leading floor ladies of the making room was put in charge. From the very first, the school became popular, and soon it was decided that all women desiring to take up work in the making room would be given instruction in the school.

The present plan is for one instructor to care for four beginners. She does not take four beginners at the same time, but has them at different stages in the learning processes.

The first process to be taken up is that of lasting. Even those who wish to be upperers begin with lasting. After they become familiar with this work, they can pass on to the work of uppering. Beginners are paid $9 a week from the time they start. No raise in wages is given until the person is able to make more than half of a regular ticket. For every six pairs more than half of the regular ticket, the worker's pay is increased 70 cents per week. The increase is continued at this same rate until the worker is able to earn $12 per week. She is then transferred from the apprentice school to the regular factory and put on piece-work. Most persons who pass through the school are able, in a short time, to make as high as $15 or $16 a week. The system has proved very satisfactory. The apprentice school is popular, and, though it requires sixteen instructors who might be used as floor women in the making department, it is an economical method of teaching beginners. New girls waste very much less material under instructors in the school than they do learning from workers in the regular factory. Furthermore, the girls advance much more rapidly, and this is a great advantage to the company as well as profitable to the workers. The real success of the school, no doubt, is due largely to the splendid work of the superintendent. Knowing the work at first hand, and possessing the qualities of a good teacher, Miss Clark is very popular among the girls and has put the school on a permanent efficient basis.

A Normal School. The United States Rubber Company, at its plant in New Haven, Conn., is working along very novel lines in the way of providing instruction for workers in their footwear factories. The work is just beginning and is still in the process of development. The assumption underlying the movement is that it is better to take teach-

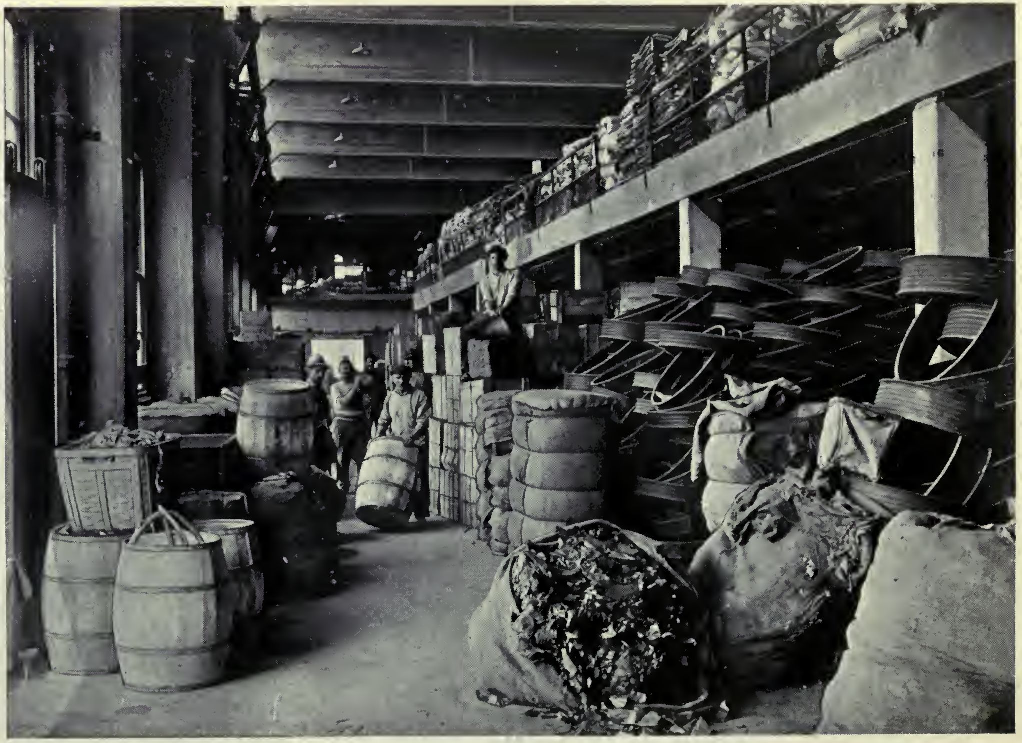
Courtesy, Hood Rubber Co.

Main room of the apprentice school at the Hood Rubber Co., Watertown, Mass.

Courtesy, Hood Rubber Co.

A making table in the apprentice school

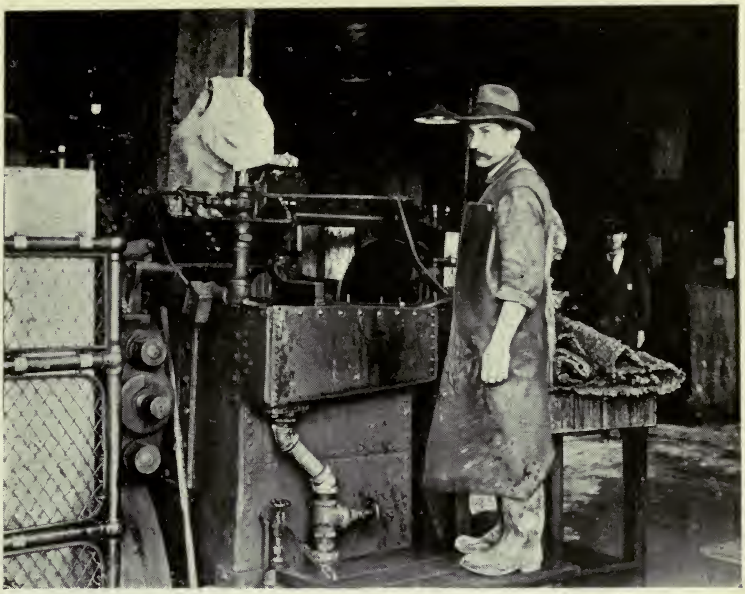
The instructor on the right is showing a beginner how to put on the outsole of a shoe



Courtesy, Hood Rubber Co.

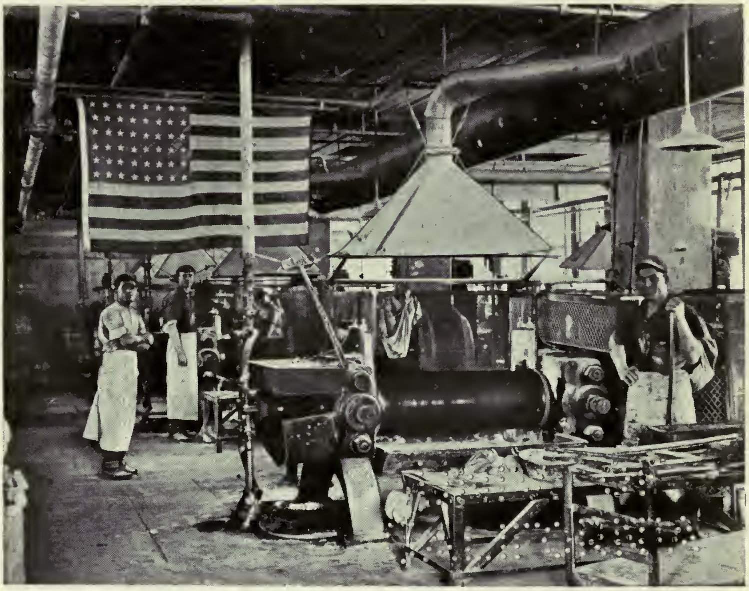
A store room in a rubber plant

To the left are barrels containing compounds. To the right from front to rear a bag of waste, rubber from the cutting room, a bale of cloth, and cases of rubber sheets. To the extreme right are steel rims for solid tires. On the second floor are bales of rubber labeled as to quality



Courtesy, Hood Rubber Co.

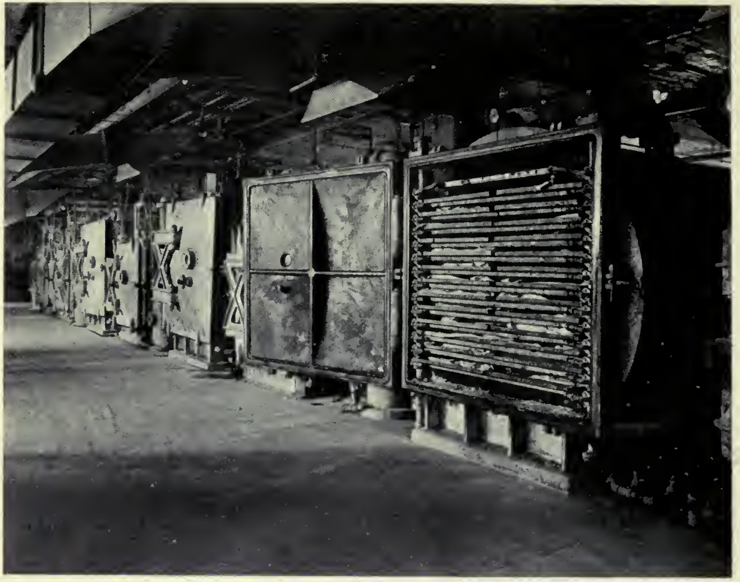
Washing crude rubber



Courtesy, Hood Rubber Co.

Mixing mill

The durability of rubber goods depends on the grades of rubber and the ingredients used in mixing the stock



Courtesy, Hood Rubber Co.

Vacuum curing ovens

Trays are loaded with rubber sheets and stacked in the ovens so that air circulates among them freely while the heating process is going on

Courtesy, Hood Rubber Co.

A kiln dryer which eliminates useless handling of materials and exposure to excessive heat. (*See page 20*) ers and put them in the factory and let them learn the making processes than to take workers and instruct them in the methods of teaching. For this reason, they have opened a training school to equip teachers to instruct beginning workers. Professor Gazell of the Department of Psychology of Yale University is supervising the work. Several persons who have made a success of teaching are now in training at the school. They have been selected from teachers, investigators, and people who have been interested in industrial work of various kinds. The method of instruction is to place the prospective teachers in the regular factory where they are doing regular work. In addition to this, a series of lectures is given from time to time by the staff, and the various problems of instruction are discussed. The object is to develop expert teachers to be sent out to their other branches to take charge of the instruction of beginners. The movement has not developed far enough as yet to show just what results may be accomplished in this way. The prospects, however, are very good, and those in charge of the work hope that it will be one means of solving the very difficult problem of securing trained workers for the manufacture of rubber goods.

Preparing Crude Rubber for Manufacturing Purposes

The principal operations, such as washing, drying, mixing, and calendering, which are involved in the preparation of crude rubber for manufacturing purposes, are practically the same whether the finished product is footwear, mechanical goods, tires, or other rubber products.

Inspecting and Grading. When a consignment of rubber reaches a factory, experts inspect and pass upon the quality of the different grades before final settlement is made. Every ball, or biscuit, is cut open and inspected through and through. The bales of smoked or crepe rubber are torn apart so that every sheet may be carefully inspected. This is necessary in order to detect disease spots which frequently develop when crude rubber is not thoroughly dried and carefully rolled or packed before shipping. The presence of moisture in rubber is sure to impair its quality. After the rubber has been carefully inspected and graded, a tag is placed on each lot indicating the quality. This tag remains with the rubber until it is mixed with other grades in the mixing room. The operatives in this department are as follows:

Hand Truck Men. The truck men unload cars, handle bales and cases on the platform, take the rubber to and from the scales, and store the different grades in labeled bins. This is unskilled work which requires unusual physical strength. The wages range in different plants from $3 to $3.25 for a nine-hour day. When openings occur in the mixing and calender rooms or among floor workers in any of the departments, the most promising truck men are transferred to these positions. Injuries of any kind which impair one's physical strength would disqualify one for this work. On the other hand, deafness, partial loss of sight, or the loss of fingers need not in themselves lessen one's efficiency.

Weighers and Inspectors. This work is entirely different from that of the truck men. Physical strength is not a primary requisite but the worker must be mentally alert, possess normal sight, be able to exercise good judgment, and be accurate in keeping systematic records. The wages range from $3.25 to $3.50 for a nine-hour day. The work offers opportunities to industrious men for advancement to positions of foremanship and other supervising work. It is well suited to men who have lost a hand, an arm, a leg, or who are afflicted with rheumatism, partial paralysis, stiffness of neck or trunk muscles, hernia, or other physical injuries.

Washing Crude Rubber. Before rubber can be used in the manufacture of finished articles, it must be thoroughly washed. For this purpose modern factories have washing machines, which consist of heavy iron frames supporting two large rolls revolving toward each other, either in a tank of water or with water sprayed over them from an overhead pipe. The surface of the rolls have spiral grooves imbedded in them, which grip the rubber and force it through the mill, tearing it into broken shreds and washing out all impurities, such as sand, dirt, splinters, wood fibre, pieces of bark, or other foreign materials. Rubber that is very dirty is soaked in water for several hours before it is run through the washing machine. After the rubber is thoroughly washed, it is taken to a sheeting machine which turns it out into sheets about one-half of an inch thick, and from two to three feet wide.

The Washing Machine Operator. The operator feeds the machine and sees that the rubber is kept constantly running around the rolls. After the rubber is thoroughly washed, the operator places it on trucks or carries it to the sheeting machine. Washing rubber is wet, dirty, heavy work. The wages average about $3 for an eight-hour shift. Wide-awake men can readily qualify for other and more desirable work, such as running mixing machines, warming machines, and calenders. This operation is not desirable for handicapped men, though deafness or the loss of fingers would not interfere with efficient work.

The Sheeting Machine Operator. A sheeting machine is very similar to a washing machine, but has adjustable devices for forming the rubber into sheets. As the rubber runs through the machine, the spray of water washes it clean of all impurities. By means of the adjustable devices, the sheets are cut in various widths as desired.

Sometimes the operator of the washing machine runs the sheeting machine also. When this is done, one or the other is always running idle, hence many plants have an operator for each. Operating a sheeting machine is more desirable work than operating a washing machine, though the wages and the opportunities for advancement are the same. The work bears the same relation to disabilities as the operation of washing does.

Drying Rubber. From the sheeting machine, the rubber goes to the dryer. The methods used in handling rubber sheets vary in the different plants and depend upon the nature of the equipment. In plants where ordinary trucks are used, the rubber sheets are usually laid out on benches about twenty-five or thirty feet long where they are cut into lengths to fit the drying trays; twelve or fifteen sheets being placed on top of one another. Where racks and elevating trucks are used, three racks, each about six feet long, are placed end to end near the sheeting machine. On these the sheets, as they are turned out, are placed and cut where the racks come together. This saves handling the rubber the second time. The following operatives are found in a typical plant:

The Sheet Cutter. This man, with a heavy steel-bladed knife, cuts the rubber into sheets from three to four feet long. The work requires medium strength and the use of one strong arm. The worker receives from $18 to $20 per week for an eight-hour shift. When openings for helpers occur in the batch cutting room, men may be transferred from this work to fill the position.

A man who had lost a hand or a forearm, providing he had the proper appliances, could do the work with full efficiency. Deafness, loss of one or two fingers on the left hand, partial blindness, stiffness of the neck muscles, or the loss of a leg below the knee would not interfere with good work, while, on the other hand, injuries to the trunk organs, rheumatism, paralysis, hernia, and skin diseases would be serious handicaps.

The Cutter's Helper. The helper stacks the rubber on the trucks, a task which requires him to lift the heavy rubber sheets higher than his head to put the last ones on. The pay and the opportunities for advancement are the same as those for the sheet cutters. The work requires strong arms, back, and legs, so that injuries affecting these members would disqualify one for this task. The loss of fingers, partial blindness, or deafness would not interfere with efficient work.

Truck Men. These men pull the trucks from the washing room to the dryers. The work is very heavy as the trucks are made to carry a ton or more at one time. The wages and the suitability of the work for handicaps are about the same as for the cutters' helpers.

Tray Loaders. When the rubber reaches the drying room, each sheet is placed on a separate tray. If vacuum dryers are used, the trays are put into the dryers one at a time. This is disagreeable work on account of the heat that pours out of the dryers when the door is opened. When kilns are used, the trays are loaded and placed on racks that hold from thirty-two to thirty-eight trays. The racks are made of iron and consist of a frame resting close to the floor, with two upright pieces, one set in the middle of the frame at each end, supporting several arms extending on both sides. The arms are just far enough apart to take the trays and allow plenty of space for the air to circulate among the trays. With elevating trucks, the racks are picked up and run into the kilns. This saves the worker from handling each separate tray in front of the open door of a dryer with the temperature from 160 degrees to 190 degrees Fahrenheit. The installation of kiln dryers is very expensive, but the firms that have installed them say the expense of installation is saved in about a year's time by the reduction of labor turnover and the greater efficiency of the kilns over the old system of vacuum dryers. After the rubber is thoroughly dried, it is stored in labeled bins ready to be taken to the batch cutting room.

The wages average about $22 a week for a nine-hour day. The worker is compelled to stoop over in picking up the lowest trays and to reach up above his head in loading the highest ones. For this reason together with the high temperature of the room, the work is undesirable for handicapped men, except in case of the loss of one eye or deafness.

Batch Cutting. There are many grades of rubber on the market, and seldom is one grade used entirely in the manufacture of any class of goods. The usual method is to mix the different grades in varying proportions according to the use that is to be made of the finished product. It is to be noted, however, that only the best grades can be used for making rubber cement. The quality of the factory rubber depends upon the proportion of the different grades of which it is composed. Experts in the laboratory make out written statements indicating in pounds the amount of each grade to be put into a certain batch. These statements are sent to the batch cutters who carry out the instructions with great care. The following are the operatives usually found in this department:

Batch Cutters. These men make up the batches according to the orders received from the foremen. Each cutter is supplied with scales which weigh to a fraction of an ounce, and he must cut the rubber to exact weight. The work can be learned in a few days without previous experience, although the best cutters are men with a number of years' experience. Proficient work requires a trained eye, quick judgment, and a deft use of the knife which has a special steel blade about fourteen inches long. The wages range from $3 to $3.25 for a nine-hour day. While the worker is obliged to move about constantly, there is very little stooping or heavy lifting, hence the work offers good opportunities to disabled men who have lost one eye, a leg, or who have received wounds that have caused stiffness of the neck or trunk muscles.

Helpers. Each cutter has a helper who assists in handling the different grades of rubber and in other parts of the work as directed. They receive from $2.50 to $3 for a nine-hour day, and are in line to become cutters when the opportunity offers. On the whole, the work bears the same relation to disabilities as that of the cutter, although the helper must do more lifting than the former does.

Inspectors. An inspector moves about among the cutters constantly in order to see that the weighing is properly done. Inspecting is pleasant work and well-adapted to men with serious physical handicaps. The wages range from $3 to $3.25 for a nine-hour day, and chances for promotion to supervising or executive positions are very good.

Handling Rubber Compounds. Not only are different grades of rubber mixed together in preparing rubber for manufacturing purposes, but other materials are compounded with the rubber. Some of the materials like sulphur and white lead, improve the serviceable quality of the rubber, while others, such as whiting and lime, are added to lessen the cost of the articles produced. If compounds were not used, all rubber goods would be either unserviceable or prohibitive in price. For instance, one manufacturer says: "Pure rubber for jar rings, with only a minimum of profit, would at the normal cost of rubber, have to sell at one dollar and fifty cents per pound, yet would seal fruit jars no better than those now sold at thirty cents. Pure rubber belting would cost a fortune, but would not transmit power so ably or so long as the belts now made of the heavy cotton ducks and *rubber compounds*, which study and experience have developed for present day use. The question in most cases is purely one of service, the exact mixtures in manufacture being the result of long and careful research." The following are the compounds most commonly used: Sulphur, whiting, zinc, aluminite, litharge, white lead, lime, red oxide, lamp blacking, mica and talc. The secrets of rubber manufacture lie largely in the various combinations of the compounds. Chemists are continually discovering new mixtures that improve rubber goods and lessen the cost of production.

The work in the compound room is light and may be called semi-skilled. It takes a beginner from a week to two weeks to become handy and a longer time to become a first-class worker. The most important work is weighing the different materials, which, for the making of tires, must be weighed accurately to a fraction of an ounce.

The dust from the different materials is disagreeable and presents certain health hazards, especially to persons inclined to lung and throat trouble. Otherwise the opportunities are good for men who have lost one leg, part of a hand, one eye, or who have defective hearing. The wages range from $3 to $3.50 for an eight-hour day.

Mixing Rubber Stock. Mixing rubber is similar to kneading bread. Various materials, such as lard and yeast are mixed with flour to make dough that will bake without becoming tough and hard. So likewise different materials, such as sulphur and white lead, are mixed with rubber to produce a compound that will remain soft and pliable after it has been baked or vulcanized.

Gum elastic shoes, such as those sold in Boston in the early twenties of the nineteenth century bear the same relation to the rubber shoes of today as unleavened bread bears to the prize loaves of a modern bakery. The analogy can be carried further, for just as success in making bread depends upon the thoroughness with which the dough is kneaded, so the success in the manufacture of rubber goods depends upon the thoroughness with which the ingredients and rubber are mixed together.

For the purpose of mixing rubber, gigantic machines are used. These machines consist of a heavy steel frame set in a base of concrete, and holding two immense cylinders or rolls which revolve toward each other. The rolls have polished surfaces and are adjustable so that they can be set to turn out rubber sheets varying in size from one-half inch to an inch and one-half in thickness.

Underneath the rolls is a large pan into which the different grades of rubber are thrown. The rolls are geared to run at different speeds, and as the rubber is fed to the machine, it gathers around the one which runs the slower. Usually it forms a sheet around the cylinder from one-half inch to three-quarters of an inch in thickness. The operator, with a sharp knife, cuts the sheet frequently, catches the rubber as it rolls off the cylinder, and throws it back into the machine. This process is continued until the different grades of rubber are thoroughly mixed together. The compounding ingredients are thrown in and thoroughly mixed with the rubber. The rolls are then adjusted so as to press the stock into a continuous sheet of rubber of the desired thickness. Helpers cut the stock into lengths of four or five feet and place it on trucks by which it is transferred to the calender room. As the rubber is laid on the trucks, pieces of cloth are placed between the sheets to keep them from sticking together.

Wages range from $3.50 to $3.85 for an eight-hour shift. A foreman in a large plant makes the following statement concerning the suitability of the work to handicapped men: "A man with an artificial leg could do any of the work in the mixing room. Even a man with two artificial legs could do the weighing of the rubber and help in other ways. While the worker must have two hands, the loss of three fingers or less would not interfere with efficient work. Workers are obliged to do a great deal of stooping so that injuries to the trunk organs would be serious handicaps. Good eyesight is necessary, and the continual noise in the room would be too much for one affected with shell shock."

Calendering Rubber. The material goes from the mixing room to the calender room. The first process is that known as cracking the rubber. For this large machines are used. The purpose is to break up the hard rubber and press it into sheets ready for the warming machines. The work of warming the rubber is done on machines very similar to mixing machines but with steam pipe attachments by means of which the rolls are heated. The object is to soften the rubber before it goes to the calenders.

Operating Cracking and Warming Machines. This is very heavy work, the operator handling as much as three or four tons of rubber in one day. On this account, the work is undesirable for handicapped men. Wages average about $18 per week for an eight-hour day, and wide-awake men are promoted to calenders as opportunities open.

Calender Operators. Calenders are large machines having three or more rolls supported in a heavy frame. The driving gears are adjustable so that the rolls can be driven either at equal or unequal speeds as the nature of the work requires. The rolls may also be adjusted so as to turn out sheets as thin as tissue paper or a half-inch or more in thickness.

One kind of calender turns out thin sheets used for the upper part of shoes and boots; another kind forms thicker sheets used for soles and heels; and still another kind coats layers of gum on fabrics used for linings, stays, and various pieces used for reinforcing different parts of the shoe. Operating a calender is semi-skilled work and the position is usually filled by men who have been working on cracking or warming machines. An average man will learn to do good work in a few months, but it requires six months or more for one to become proficient. The wages average about $24.50 a week for a nine-hour day. The work is much lighter than that of washing and mixing rubber and offers favorable opportunities for men whose injuries unfit them for hard physical labor. Men with artificial legs are doing this work in some plants with perfect satisfaction.

A calender operator has from two to five helpers, according to the type of the machine and the nature of the work that is being done. Those who show themselves competent as helpers are in a position to be promoted as operators of a calender. Wages range from $19 to $20 per week for a nine-hour day. The work is quite varied and men who have lost fingers, especially of the left hand, or a leg below the knee would be able to do efficient work.

Reclaiming Old Rubber

The reclaiming department takes automobile tires, boots, shoes and other old rubber articles and works them over into a low grade of rubber, known as shoddy. The various processes are as follows:

Sorting. The old tires are sorted according to quality and color. The quality depends upon how much the tire has been used and whether it has been over oxidized or not. The worker must use his judgment in sorting the tires as to their quality. As to color, tires are sorted into those that will make white, gray or black shoddy. The worker cannot tell by looking at the tires which color of shoddy they will make, but must depend upon the name of the manufacturer. The laboratory of the reclaiming department has analyzed the tires of the various manufacturers and has determined the ingredients used by each maker. The color of shoddy depends upon the ingredients used. Of course, manufacturers change their formulas from time to time so the laboratory department has to be on the lookout for this.

It usually takes a man about three months to become a good sorter and a longer time to be able to earn the highest wages. Wages range from $20 to $21 per week for an experienced man, while helpers receive about $19. The work is usually done out of doors and is therefore suitable for men with weak lungs. Most foremen are of the opinion that a man with one arm, one leg, a stump of a hand, or hernia could do satisfactory work. Wide-awake men have splendid opportunities for advancement to positions which pay better wages.

Cutting Off Beads. The beads of tires are cut off by machines. The operator holds the tire on a platform which revolves under a knife. The work is not hard, but requires the use of two good hands and one must move about considerably in handling the tires and holding them on the machine. On this account the work is not suited to men with handicaps, although the loss of one or two fingers or defective hearing would not interfere with efficient work. Wages average about $25 per week and the opportunities for advancement are good.

Stripping Beads. This work consists in stripping the fabric and rubber off the metal bead. It is heavy work and very disagreeable on account of the fact that the beads must be soaked in water and stripped while wet. The operator receives about $28 per week for a nine-hour day.

Weighing. Weighing the tires is light work which could be done satisfactorily by one who had lost a leg, an arm below the elbow, or who had trunk injuries or hernia in a light form. The work requires mental alertness and offers splendid opportunities for advancement. Wages range from $20 to $22 per week. The average man would learn to do this work well in about two weeks.

Cracking and Grinding. After the tires have been weighed and washed they are taken to a cracking machine which breaks the rubber into large pieces. These pieces are then shoveled into another machine which grinds them into small particles. Underneath the rolls of the grinding machine is a pan from which an upright conveyor carries the material to a hopper, ten or twelve feet above the floor. The bottom of the hopper is covered with a quarter-inch mesh screen and all the pieces which are too large to pass through the screen go back to the grinder. The operation is continued until all the material is ground fine enough to pass through the screen. Horizontal conveyors carry the fine product to an apparatus called a riffler, which consists of a long trough into which a stream of water constantly pours and carries the material along. Gravity is by this means used to segregate the foreign substances. As the material is washed along the riffler the heaviest parts settle to the bottom and only the lightest material is carried on to the farther end of the trough.

One operator with three or four helpers takes care of the cracking, grinding, and riffling of the rubber. The operator receives about $22 per week and the helpers receive $21. The work of handling the rubber as it goes through these machines is very heavy, some of it being done with large shovels, which require strong arms and strong back muscles. There is a considerable amount of walking back and forth so that on the whole the work is not suited to men with serious handicaps. The loss of one or two fingers or defective hearing would not interfere with satisfactory work. It takes about a week's time for a man to learn to operate a machine; helpers could start in immediately.

De-Vulcanizing and De-Fiberizing. The material as it comes from the riffler is collected into tanks where it is reduced to a liquid by means of chemicals and heat. Caring for the chemical tanks or de-vulcanizers, as they are sometimes called, requires a considerable amount of walking and because of the extreme heat is not suited to handicapped men. Most plants employ Americans for this work. Wages range from $20 to $22 per week. A man will learn the operation in about three weeks' time. The position offers good opportunities for advancement to minor executive positions and foremanship.

Pressing. From the de-vulcanizer the material goes to large screw presses. The presses are long and tapering, being about four feet in diameter at one end and gradually sloping to a diameter of two feet at the other end. The frame is made of slots with small crevices between them through which the liquid passes as the material is forced through the press. Pipes are arranged to convey the liquid into evaporating tanks. The dry material is taken directly to the drier. Wages for this work average about $22 a week. The work could be done no doubt by one who has lost a leg below the knee, provided he had a suitable appliance. The loss of two or three fingers would not handicap one.

Drying. The pulp is dried by an apparatus which consists of a blower surrounded by steam pipes. The blower forces hot air through the material and dries it thoroughly within a few minutes' time. After the material has been dried it is stored in long shallow bins or pans, arranged so that there is a vacant space beneath them of about two feet. Steam pipes extend through this space beneath the pans and keep the material perfectly dry until it is to be used. Caring for the drier requires one to climb up ladders, walk back and forth through a room about fifty feet long, and handle the material with shovels, which require the use of both hands. The work is not therefore suited to men with serious handicaps. Wages average $22 a week.

Straining. Before the rubber is taken to the refiner and worked into rolls for manufacturing purposes it is passed through a straining machine which removes all foreign particles, such as splinters and pieces of metal. The strainer is made on the principle of a sausage grinder; the material is fed into the hopper leading to a revolving auger, which forces the material through a fine screen which removes foreign substances. Operating the strainer is light work and could be done by one who had lost a leg or who had trunk injuries, defective hearing, or hernia in a light form. Wages average about $22 per week.

Refining. From the strainer the material goes to a refiner, which is very similar to a calender, although, as a rule, one of the rolls is much larger than the other one. The object is to turn out the rubber in very thin sheets so that if any foreign particles should have passed through the strainer they would be thoroughly crushed by the refiner. As the sheets come from the refiner they are folded together forming, what appears to be a solid roll of shoddy about six inches in diameter and three feet long. This completes the reclaiming processes and the rubber is ready to go to the batch cutting room and to be mixed with other grades of rubber for manufacturing purposes. This work pays about $22 a week. In one plant, at the present time, a man who has lost an arm is doing highly satisfactory work. The work is light and could be done without doubt by one who had lost a leg below the knee, or who had trunk injuries, defective hearing, or hernia.

Preparing Cloth for Calenders and Spreaders

In the manufacture of footwear, automobile tires, and many other rubber goods, a large amount of cloth is required. Different qualities of cloth are used for the different articles, ranging all the way from light cheesecloth to very heavy duck. The following are the principal operations involved in preparing it for calenders and spreaders:

Weighing, Winding, and Measuring Cloth. The cloth comes to the factory, as a rule, in immense cases weighing from 600 to 800 pounds each. These are handled by hand trucks and placed in the cloth room. Here the iron hoops are cut off and the cases unpacked. The next operation in connection with the cloth is to weigh, measure, and wind it into 300 or 400-yard lengths. This work is done on a simple machine consisting of a platform about ten feet long on which is mounted a frame carrying, as a rule, four rollers. As the cloth is about a yard and a half in width, the rollers must be about six feet long. The process consists in running the cloth around these rolls and over a measuring drum to the winding reel. The object in having a number of rolls is to smooth out and stretch the cloth tight before it passes over the measuring drum. After the cloth has been wound tightly on the winding reel, it is taken to the dryer. The work of weighing and measuring cloth is comparatively light with the exception of the handling of the rolls. Where an operator and two helpers work together, one of them would be able to do efficient work if he had lost a leg below the knee, a part of his hand, or perhaps an arm below the elbow. At least two of the men must be able-bodied in order to handle the heavy rolls. Operators receive $21 a week and helpers $18.50. The opportunities for advancement to calender work are good.

Burling. Cloth that is used in the manufacture of fine goods must be entirely free from knots and loose threads. The work of picking out the knots and loose threads is done by women, and is known as burling. Every inch of the cloth must be inspected by them. The work is done at a table while the operator is seated. Most foremen feel that women are better adapted to this work than men, though it is sometimes done by the latter. All of the heavy work now is done by floormen so that if handicapped men were employed, no change would need to be made in the usual routine of work. Women receive from $14 to $16 per week on piece-work.

Drying Cloth. After the cloth has been measured, it is taken to the drying machines. For this purpose, most plants have two styles of dryers: A can dryer, constructed to turn out a very large quantity of work on all kinds of fabrics, from net fleeces to heavy ducks; and a cell dryer used mostly for the heaviest goods.

The can dryer is a rather complicated machine from the point of view of structure but simple in operation. The principal part of the machine consists of a heavy steel frame supporting six large cans two feet in diameter and five or six feet in length. The six cans are arranged three on one side and three on the other side of the frame. The cloth is placed on a bench near the machine and runs around the first roller on one side of the machine and then around the first one on the opposite side, and so on around all of the cans. From the last can, the cloth goes over a roller at the top of the frame and then down to another roller near the floor and, from this roller, over a measuring drum and then out to a winding reel. The large cans are heated by steam so that the cloth is thoroughly dried. From the dryer, the cloth goes either immediately to the calender room or to a store room kept free from moisture by artificial heat. As a rule, one operator and a helper run the can dryer. The loss of one or two fingers or defective hearing would not interfere with good work. A one-armed man would be able to do satisfactory work as an operator providing the helper was able-bodied. While there is not much dust connected with the work, there is, undoubtedly, enough to make it impossible for one with weak lungs to do work with safety. Operators receive from $19.50 to $21 per week, while helpers receive from $18.50 to $21. Opportunities for advancement to the calender room are good.

The cell dryer is simple in construction, consisting of a heavy steel frame supporting four cells about five feet wide and six or eight feet long and seven or eight inches deep. The cells are made of cast iron and are hollow so that they can be filled with steam. The cloth runs around them in practically the same way as around the cans on the other dryer and is conducted from the cells to a measuring drum which records the yardage. From here it is wound on a roll ready to be taken to the calender room. As mentioned above, this style of dryer is better adapted to heavy than to light cloth. The work of operating it is similar to that of the can dryer, and wages and opportunities for advancement are the same.

Cutting Rubber Stock for Footwear

After the material has been prepared as described above, it goes to the cutting room where the various parts are cut out. The principal operatives in the footwear cutting department are as follows: (1) Stock Receivers, (2) Stock Carriers, (3) Cementers, (4) Die Cutters, (5) Gum Coverers, (6) Upper Cutters, (7) Outsole Cutters, (8) Outsole Cutting Machine Operators, (9) Back Hand Cutters, (10) Parsons Press Operators, (11) Clicking Machine Operators, (12) Seelye Machine Operators, (13) Electric Machine Operators, (14) Laying Forms, Rolling and Booking Operatives.

1. Stock Receivers. As the rubber comes from the calenders, it is transferred on long canvas belts directly to the cutting department, where it is received on reels or placed on frames about ten feet long. Plain rubber sheeting is easily handled on reels, but sheeting on which forms have been imprinted must be handled without being rolled. Receiving the rubber sheeting on reels is the lightest kind of work and is usually done by women. It could easily be done by men with an artificial leg, a stump of an arm, trunk injuries, heart diseases, or hernia. The work of handling frames is light and suitable for men who have lost a hand, a forearm, a leg below the knee, or who have received other injuries which make it impossible for them to do hard work. The wages range from $20 to $22 per week and the workers are in line to be advanced as cutters or machine operators.

2. Stock Carriers. Stock for the upper part of a shoe is received either on frames or on reels; stock for soles is placed on boards about two feet wide and three feet long with cloth in between the rubber pieces to keep them from sticking together. In this way, twelve or fifteen sheets are carried on one board, or book as it is called, while only one layer of rubber is carried on a frame. The books, frames, and reels are transferred to the cutting tables either by trucks or by hand. Although the work is not very heavy, it is not suitable for wounded men except in cases of finger amputations, deafness, or partial loss of sight. Wages range from $20 to $22 per week, and the men are in line to be advanced to better positions as they are needed.

3. Cementers. The various parts of the rubber shoe are cemented rather than sewed together. This requires that each piece be either cemented over its entire surface or along the margin. Most of the work is done by hand but some plants have installed machines for cementing inner soles. The work of cementing is done on tables and is not heavy but requires a considerable amount of walking about. Wages range from $16 to $20 per week. Now and then some workers make as high as $30 by piece-work. Women and boys are doing most of this work at the present time. There seems no reason, however, why men with artificial legs, weak lungs, heart disease, trunk injuries, rheumatism, or hernia might not be employed at this work satisfactorily.

4. Die Cutters. Many of the smaller parts for footwear are cut by hand dies. The men who do this work are known as die cutters. They have dies with handles attached which enable them to set the die with one hand and strike a blow with a mallet with the other hand. Experienced men are able to turn out work very rapidly. Using a small die is light but tedious work while operating a large die is very heavy work. The operator must not only stand all day long, but must move about to get his stock and to place the parts in the book after they have been cut. Whether or not the work would be suited to men with various handicaps would depend very largely upon the attitude of the man. A person who could stand all day long on an artificial limb would find the work very satisfactory. The wages range from $25 to $30 a week.

5. Gum Coverers. This is a process in which the parts which have been cut from fabric are laid on rubber sheets and the rubber parts are cut with a knife to match the fabric parts. The work is very similar to upper-cutting, though not quite so heavy. Women work at this operation in many plants at the present time though men are still employed in large numbers. The wages range from $25 to $30 per week on piece-work. Men who have lost a leg or who have weak lungs, heart disease, or defective hearing could do this work without much difficulty. It takes about three weeks for the average person to become handy at this operation and a much longer time for him to become competent to earn the highest wages.

6. Upper Cutters. Most calenders used for turning out stock for the upper parts of shoes have prints on the surface of the rolls which mark the patterns which the cutter follows in cutting the stock. This enables the worker to use a knife instead of a die. The work is not heavy but brings into action practically every muscle in the body, as a man must be able to cut patterns of many different forms. Besides the motions necessary in cutting the stock, the operator must step to one side of the cutting table to obtain the rubber and turn around to place the parts in books. Though the work is not hard, it involves so many different motions that it would be very difficult for a man with handicaps of any kind to do efficient work, though a man who had lost a leg below the knee might do satisfactory work. Again, it must be said that, while this is true in general, men differ so widely in their ability to overcome handicaps that the most one can say is that this operation is unsuited to disabled men except in cases of unusual adaptability. Wages are paid by piece-work. Proficient cutters often make as high as $35 or $40 per week. As this is one of the best paying operations in connection with the manufacture of shoes, there is very little opportunity for advancement.

7. Outsole Cutters. Outsole cutting is heavier work than cutting the upper parts of shoes. The operator uses a back-hand stroke and, at the same time, must learn to cut the edge on a bevel. The operation involves about the same motions as that of upper-cutting and bears practically the same relation to handicaps. Wages are paid by piece-work, and men average from $30 to $35 per week.

8. Outsole Cutting Machine Operators. Outsole cutting machines are used in many factories to do the work of cutting the heaviest soles. It is a very simple machine with a knife arranged to revolve so as to trace the form of the sole. It can be adjusted to cut small or large patterns. The operator controls the machine with a tread and moves the rubber sheeting along the table under the knife as the machine is in operation. It takes about six weeks for a man to become expert at handling the machine. Wages average from $25 to $30 per week on piece-work. Men who had lost a leg, one or two fingers, or who had received slight physical injuries to the trunk organs would be able to do the work with very little loss of efficiency.

9. Back Hand Cutters. Patterns for samples and odd jobs are cut by hand as the price of making dies would be prohibitive. Back-hand cutters are also called upon to do work when machines have to be repaired. The operator grips the knife in the palm of his hand and makes a backward stroke in cutting out the pattern. Well-trained men can cut from twelve to fifteen plies at one time. While the stroke is the same as that used by the outsole cutters, the cutting must be done straight and not on the bevel as is the case with the outsole work. This operation varies greatly in the different shops and in the same shop at different times, which makes its nature more or less seasonal. During steady work, operators will average $20 to $25 per week on piece-work. While the work could probably be done by men who had lost a leg or who had received slight physical injuries to the fingers or left arm, it is, as a whole, undesirable for handicapped men.

10. Parsons Press Operators. Cutting rubberized fabric is usually done on machines. For this work, there are a few standard types, such as the Parsons, the clicking, and the Seelye machine. The Parsons machine is the strongest and is made to do the heaviest kind of work. It consists of two heavy wrought iron legs supporting a press table and a huge beam hammer which is connected by four very large rams with an eccentric drive. The driving shaft is connected with a friction clutch which is joined with a brake in such a way that when the clutch is free the brake is set. The brake holds the hammer up while the operator sets the die. The clutch is thrown in place by means of a foot tread. The machines are made in several sizes with the hammers running from four to six feet in length. The operator handles the die with both hands but would, no doubt, be able to do satisfactory work with a loss of one or two fingers, provided he had the first finger on each hand. The work is not hard but there are hazardous features about it that make it necessary that the operator have sound physical health and good mental poise. Should he trip the machine while setting the die, he might lose both hands or even both arms. From fifteen to thirty plies of fabric are cut at one stroke which indicates something of its tremendous power. It usually takes about six months for one to become skilled in operating this machine. Wages by piece-work range from $35 to $40 per week. Each operator has a helper who receives from $15 to $16 per week, and is in line to become an operator of the clicking or Seelye Machine. Men with a part of a hand, a stump of an arm, or an artificial leg could do efficient work as helpers.

11. Clicking Machine Operators. The clicking machines are adapted to cutting toe tips, juniors, or counters, fillers and other small parts of the shoe. It consists of a cutting board or block over which a strong arm or beam about three feet long swings from side to side. The arm is attached to an eccentric drive by a large spindle about eight inches in diameter. The operator of the machine sets the die upon the fabric just as a hand worker would place a pattern upon it then swings the arm of the machine over the die and trips the machine with the same hand by which he swings the arm of the machine over the die. After the arm hits the die it returns automatically into place. There is very little danger involved in operating this machine, and the average man can learn to run it in about two months, though it takes a longer time for him to become an efficient worker. The operator has no helper and must count and mark the parts as he cuts them. Wages average from $30 to $35 per week by piece-work. Many foremen are of the opinion that though the work requires the operator to stand continually that it could be done by one who had an artificial leg or ankylosis of the knee or hip joint. Men who have defective hearing or who have lost two or three fingers except the first finger would be able to do satisfactory work.

12. Seelye Machine Operators. The Seelye machine is built on the principle of the Parsons press machine but is not so strong. It is, however, adapted to doing heavy work with less waste of material. The operator does his own counting and marking and is paid by piece-work. The rate, as is the case with the other machines also, varies with the proportion of waste stock left at the close of the day. The work bears about the same relation to handicaps as that of the clicking machine. It takes from two to three months to learn to do good work and a longer time to become master of the machine.

13. Electric Machine Operators. Many shops have introduced electric hand machines to cut large patterns from rubberized fabric. The work consists in marking out the patterns and operating the machine. In some plants two men work together. Both are experts and take turns at marking and operating the machine. They are paid by piece-work and often make $30 to $40 per week. Sometimes the machine operators lay out their own stock, but usually helpers do this work. Laying out stock is an operation which is well adapted to men who have received injuries that unfit them for hard physical work. The wages range from $15 to $20 per week, and the men are in line to be promoted to more desirable positions as opportunities offer.

14. Laying Forms, Rolling and Booking Operatives. Many parts of rubber footwear are made double; one part being made of fabric and one of rubber. Laying forms consists in taking the similar parts of fabric and rubber and placing them together. In some plants girls do this work while in others boys do it. Girls receive from $12 to $15 per week while boys make as high as $20 or more.

After the forms have been laid, they are taken to the rollers where they are run through a press consisting of two rollers arranged on the principle of a common clothes-wringer. This is to remove all wrinkles and air pockets and to press the rubber and fabric together. The operation requires two persons, one to feed the machine and one to receive the parts and place them in a book again. The work is light but requires quick movements and continual standing. Men with weak lungs, heart disease, or defective hearing would find this work very satisfactory.

From the rollers, the patterns go to a room where girls make up books. This work consists in taking the number of each part which one worker will use during a day and placing them in books ready to go to the making tables. At the present time girls are employed at this operation. Wages average about $15 a week. The only thing that would debar men with serious handicaps from this operation is the low wages. The average person can learn to do this work in about one week's time.

Making Rubber Shoes

Rubber shoes are, for the most part, made by hand. The various parts are put together with cement instead of stitching as is the case in leather shoe making. The principal operations are as follows:

Lasting. The first operation in the making of a shoe is known as lasting. Taking a last, the operator first covers it with what is known as the shoe lining. After this has been stretched smoothly over the last and the edges folded over the bottom, the inner sole is put in place. On the best quality of shoes, a strip of rubber three-quarters of an inch in width is run around the edge of the sole. With a gauge, the laster marks the shoe for the upperer and then cements on the junior or counter as it is called in shoe manufacture; the heel piece; the filler; and the toe piece. With a rubber roller, the different parts are rolled out smooth and the seams pressed down tight. The work is usually done by women who earn, by piece-work, from $15 to $20 per week. This operation would offer suitable employment to men who have injuries affecting the lower extremities. Most manufacturers, now, however, prefer women for this work.

Uppering. Beginning where the laster left off, the upperer first places the vamp (*i. e.*, the part which forms the instep of the shoe) in place as marked by the laster and folds the edges over the top of the sole and joins the ends together to form the heel seam. The shoe is then carefully wiped with a cloth and rolled smooth with a rubber roller. The rubber junior is then put over the heel and a seam is run around the edges of the junior and the sole to give the shoe a finished appearance. The shoe now goes to the outsoler. The nature of the work and the wages paid are the same as in lasting.

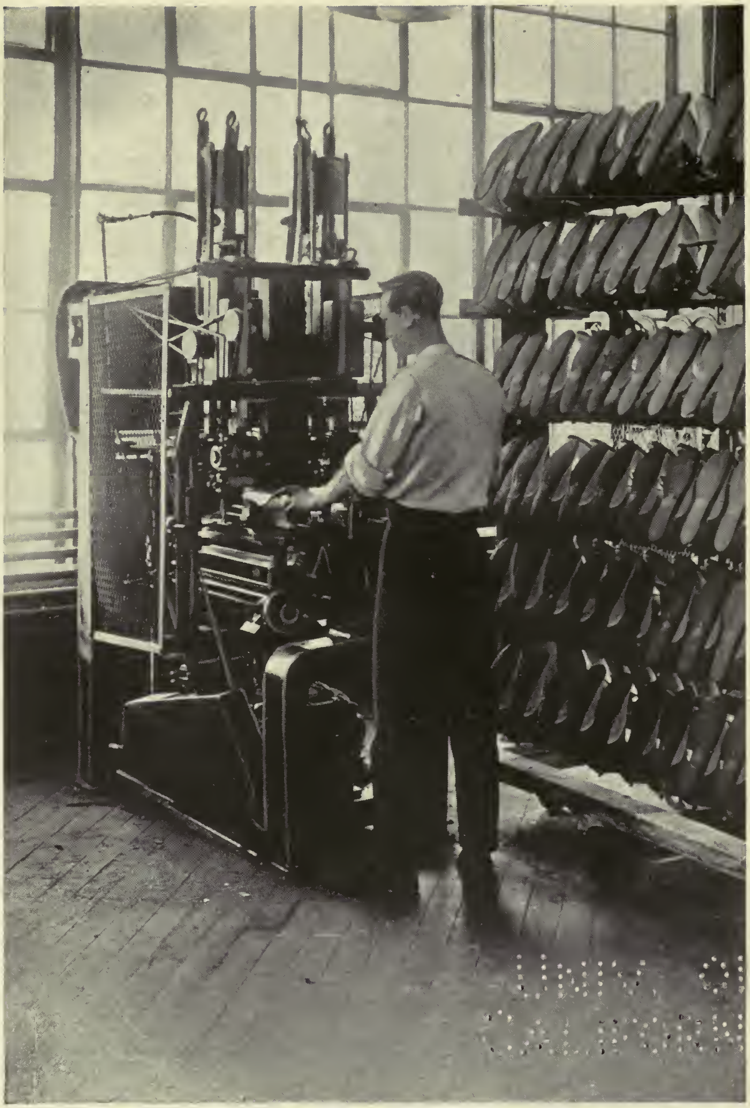
Outsoling. The first operation of the outsoler is to cement the soles and place them on the shoes to dry. After they have had time to dry properly, they are rolled down with a heavy roller. Outsoling is particular work as it gives the final appearance to the shoe. In most plants men do this work and the wages average about $25 per week on piece-work. The work requires the full use of the arms and hands, and, on the whole, is not well suited to handicapped men except cases of deafness and slight injuries to the lower extremities.

Checking. Rubbers go from the outsoler to the checkers. These persons, usually girls and boys, check all the shoes and credit to each worker, by number, the exact number of shoes of each kind made by the worker during the day. The workers' pay is determined by this record. Should any of the shoes be damaged after they pass the checker, the worker would receive full pay regardless of what damage had been done.

Two persons work together at checking the shoes; one counts the shoes and the other one checks the counts on checking forms. The work of counting the shoes involves a good deal of walking about, but, as the shoes are handled one at a time, no heavy lifting is necessary. At the present time, most plants employ boys for this work. There is no reason why men with serious handicaps, such as trunk injuries, heart disease, the loss of one leg, the loss of an arm, hernia, paralysis, or weak lungs could not do the work with satisfaction. The work of checking is done at a table while the person is seated. Girls are usually employed at this work and the only thing that would debar handicapped men who were able to write well would be the low wages paid. Girls receive from $12 to $15 a week for a nine-hour day.

Varnishing. Before the shoes are vulcanized, they are varnished with a preparation which gives them the appearance of patent leather and renders them capable of withstanding great changes of temperature without cracking. Shoes with cloth tops are varnished by hand while whole rubber shoes are dipped in the varnish. Hand varnishers make, by piece work, from $32 to $33 a week while operators of dipping machines make as high as $35 to $40 per week. The work involves a considerable amount of moving around as well as lifting bars with from six to twelve shoes at a time. It is, therefore, not suited to men with other handicaps than the loss of one or two fingers or defective hearing.

Vulcanizing. After the shoes have been varnished, they are taken to the vulcanizers in lots technically called heats. Each



Courtesy, Hood Rubber Co.

Automatic rolling machine

One man can roll several thousand shoes in a day

heat contains from six to eight cars and each car contains from eighty to two hundred pairs of shoes. Vulcanizing rubbers is a very particular piece of work. The foreman in the laboratory makes out a curing schedule for each lot of shoes. Heat is applied by means of steam pipes which extend underneath the floor and sometimes around the sides of the room. A thermometer is placed at each corner of the room and the man in charge must see that the heat is distributed evenly throughout the room. For the best results the temperature must increase gradually until it reaches about 260 degrees Fahrenheit. Different shoes are left in the curing room different lengths of time, but it takes four to eight hours for the shoe to cure well. The work is heavy and requires able-bodied men with more than ordinary physical strength. Wages range from $27 to $30 per week for a nine-hour day.

Making Rubber Boots

The work of making rubber boots is very similar to that of making shoes but it is heavier and involves more operations. Some plants follow two methods in making boots, the old or individual method in which one person makes the entire boot, and the new or team method in which a number of men work together, each doing a certain part and passing the boot on to others who do their parts in turn. The following are the principal operations involved in making boots by the team method:

Lasting. As mentioned above, in most plants the work of making boots is done by a group of men working together. The first operator does what is known as lasting. The work includes the following: Putting on leg lining, inserting inner sole, strapping up the leg lining, placing on the toe lining, putting on the rag sole, the cloth heel stay, the rubber heel stay, the cloth front stay, the rubber front stay, the inner vamp, the ankle piece, and the knobs.

Legging. The laster then cements the boot and places it on a truck to be taken to a parking place or passes it directly to the next operator who performs the work known as legging. It consists of putting on the rag counter, the leg cover, stitching the knobs, and stamping on the label and the worker's number.

Vamping. The boot goes from the legger to the vamper who performs the following operations: Putting on the rubber counter, inserting the outer filler, placing on the vamp, the toe foxing, the back strap, stitching the sides and back of the vamp, and stamping on the worker's number.

Outsoling. From the vamper the boot goes to the outsoler who cements the boot for the outsole, puts on the outsole, cuts off the toe strips, and puts on the binding.

Putting on the Top. Outsoling finishes the low top boot, but storm, sporting, and hip boots go to another worker who performs the following operations: Cements on the top, puts on the boot chafing strips, rolls and stitches the seam, and dusts the top with a cloth.

Low top boots reach about to the knee; storm boots to a little above the knee; sporting boots well up on the hip; and hip boots reach up to the belt to which they are strapped.

Handling the boots during the process of manufacture is hard work, but does not involve any heavy lifting. The work is done while the operator stands and is not suited to men with serious handicaps, though one who has lost one or two fingers, has defective hearing or a light form of hernia could do the work with satisfaction. Some foremen say that men with an artificial leg could be used to good advantage. This, no doubt, depends upon the attitude of the person himself. Wages range from $30 to $35 a week for a nine-hour day. It is the most popular operation among the men, and floor men, truck loaders, and last strippers are all anxious to become boot makers. The average man can learn to do the work in one to six weeks, but it takes longer for him to become competent to earn the highest wages.

Individual Boot Making. Where one man makes the entire boot, the work is better adapted to handicapped men. Individual workers often sit at the table while performing the various operations and, as a rule, do not have to move about so much to obtain the material. In some plants men who are not able, on account of age, to keep up the speed in team work are allowed to do individual work. Men who have lost a leg or who have heart disease, defective hearing, or hernia could do efficient work at this operation. It takes six months or more for the average man to become a good boot maker.

Making Arctics, Gaiters, and Lumberman's Shoes

The making of arctics, gaiters, and lumberman's shoes is classed as heavy goods work and usually associated with boot making.

ARCTICS

The work of uppering and lasting is very similar to the same operations in gum shoe manufacture. Arctics are made in light and heavy weights and with cloth or rubber tops. The principal operations involved in making arctics are as follows: Assembling tops, lasting, and outsoling.

Assembling Tops. The tops or quarters, as they are called, are assembled in a room separate from the making room. The forms are laid out on a table and a strip known as the pocket is cemented around the edges; the buckles, or ladders and take-ups, as they are called, have rubber tabs attached to them. The ladders and take-ups are set in place by the help of a stencil gauge and a strip of piping is cemented over the tabs. The piping is rolled down with a heavy rubber roller, and the quarters are ready to go to the making department.

Lasting. The laster usually does the work done by both the laster and upperer in connection with shoe making. The work consists in putting in place the lining, the insole, the shank, the junior, the toe tip, the piping, the vamp, the quarters, the fillers, and the foxing. Men, as a rule, do this work and receive from $25 to $30 a week on piece-work. One can pick up the work in a few days but it takes about two months to be able to make the highest wages. The work requires able-bodied men, though one who had lost one or two fingers or who had defective hearing or ankylosis of the knee or ankle might be able to do the work without much loss of efficiency.

Outsoling. Outsoling is almost identical with that of making light rubbers, with the exception that it is heavier work. Men often make as high as $35 on piece-work after they have been working for several months. The work could be done by one who had lost a leg below the knee providing he had a suitable artificial limb. The loss of one or two fingers or defective hearing would not interfere with satisfactory work.

GAITERS

Gaiters are very similar to arctics; shoes with one buckle only are called arctics while those with two or more buckles are called gaiters. Gaiters range from the low two-buckle to the high six-buckle shoes. Some women's gaiters are made with buttons rather than buckles and some men's shoes are made with eyelets instead of buckles. Lace shoes range from four to eight eyelets. The work involves the same operations, pays about the same wages, and bears the same relation to handicaps as that of making arctics.

LUMBERMAN'S SHOES

Lumberman's are a very heavy shoe, about midway between gaiters and rubber boots. Some are made with cloth tops and some are made with rubber tops fleece-lined. The cloth tops are assembled in the same way as those of arctics, and the operations are about the same, though, in some styles, a number of additional parts are added to give strength and service to the shoe. The nature of the work is similar to that of making arctics and bears about the same relation to disabilities. In many plants, the operator makes the entire shoe, and, where this is done, men with injuries to the lower extremities would be able to do the work without the loss of efficiency. Men who are experienced average from $30 to $35 at individual work.

Making Tennis Shoes

A great many different kinds of canvas shoes are being made today under the general name of tennis shoes. They range all the way from the hospital slipper and the pump to the men's work shoe and the women's fancy high top shoe with twelve or more eyelets. In some plants, lasting machines and welt stitching machines have been installed. The typical operations are discussed in the following sections:

Stitching. The canvas parts that go into the making of the top are sewed on machines. At the present time more women than men are working at this operation. The work is light and offers splendid opportunities for men with artificial legs, trunk injuries, hernia, light forms of rheumatism, ankylosis of the knee or the hip, or other disabilities that would disqualify one for hard physical work. Women receive from $14 to $16 a week for a nine-hour day; men, on piece-work, make as much as $23 per week.

Lasting. This work is done partly by hand and partly by machines. The hand worker, usually a woman, puts on the insole, the steel shank, the fabric shank, the counter, the rag sole, and the heel stay. The machine laster merely draws the vamp over the sole and fastens it in place with tacks. High grade shoes then go to a buffer who polishes the shoe with an emery wheel.

Cementing. The laster passes the shoe to another worker who spreads a thick coating of cement over the bottom of the shoe. One cementer does as many shoes as two lasters and two upperers. The work is done by women.

Uppering. The work of uppering on a tennis shoe is very light. It consists principally in putting on a narrow strip of rubber called foxing around the edge of the shoe and a tip on the toe.

Outsoling. A part of this operation is done by hand and a part by machinery. When women do outsoling, they simply put the sole in place, and the shoe is then taken to a machine which rolls the sole down and presses it on firmly. Where men are used for this work, they usually do the entire operation.

Automatic Rolling Machines. Many plants have installed automatic rolling machines for rolling down the soles. The machine is very complicated in structure but rather simple to operate. The worker sets the shoe in place, pushes a switch with the hand, and the machine carries the shoe under heavy rollers and back again to the place of starting. Most machines are double so that while one shoe is going through the machine, the operator can be setting another shoe in place. In this way he will roll as high as 30,000 or 40,000 shoes in one day. The work is very light and could be done by one who had an artificial leg, a stump of a hand, weak lungs, heart disease, defective hearing, trunk injuries, or hernia. Wages range from $23 to $28 per week for a nine-hour day. The average person can learn to operate the machine in less than a week's time.

Power Edging Machine. The power edging machine is made to be fastened to a post or standard at a height suitable to the operator. The principle parts are: A motor, a rubber hammer, and a steel edger. The hammer and edger are attached to a shaft which has direct connection with the motor. The machine is made so that the motor drives the hammer at a very rapid speed with a stroke of about one-half inch. The operator merely holds the shoe up against the hammer and the action of the machine rolls the sole down firmly. The edger works on the same principle as the hammer and the operator holds the shoe so that the sole is trimmed and the foxing is stitched at the same time. In many plants, women work at this operation and receive from $19 to $23 on piecework. Men who have lost a leg, who have weak lungs, heart disease, defective hearing, or trunk injuries, could do this work with satisfaction.

The women lasters, cementers, and upperers receive from $14.50 to $17 per week while women outsolers receive from $16.25 to $20 per week. Men outsolers average about $23.

All wages are paid by the piece-work. Men operating power-edging machines and outsoling machines receive from $19 to $23 per week. Any of these operations can be learned by the average person in from one to two weeks' time, but it takes several months' experience for one to earn the highest wages. Outsoling, whether done by hand or by a machine, could, no doubt, be satisfactorily done by men who had lost a leg or men with weak lungs, heart disease, defective hearing, trunk injuries, or hernia.

Packing Rubber Footwear

Work in the packing room is varied and offers attractive employment to both men and women. The most important operations are treated in the following paragraphs:

Stripping Lasts. The shoes go from the curing room to the packing room. The first operation here is that of stripping. The floor men push the loaded cars to the stripper's table. The work of removing the shoes from the last is heavy work and requires a man with more than ordinary strength. Sometimes the shoes have to be pried loose from the last with an instrument. In some plants, this work is done at night. The work is not suited to handicapped men though the loss of one or two fingers or even the loss of a leg below the knee would not necessarily incapacitate one.

Trimming. The top of the lining of shoes and the binding around the top of boots must be trimmed off after the shoes come to the packing room. Some plants are, at the present time, employing women to do this work, though men are employed in large numbers. Sometimes a knife is used and sometimes a pair of shears. The work is not heavy but it is so varied that it is not suited to men with handicaps other than the loss of one or two fingers or defective hearing. Experienced workers make as high as $35 per week on piece-work.

Wrapping. The best grades of footwear are carefully wrapped before being packed in cases. This work, in itself, could be done by a man who had lost a leg either above or below the knee, or who was afflicted with heart disease, paralysis, defective hearing, or weak lungs. In most plants, however, the worker has other things to do besides wrapping shoes and, where this is true, men with the handicaps mentioned above would not be able to fit in.

Inspecting. The work of inspecting in the packing room involves so many different things that it is undesirable for handicapped men. The inspector must not only be competent to judge of the workmanship, but he must handle the goods and move about in the room continually. The inspector is paid by the day and receives from $25 to $27 per week for an eight-hour day. The work is light and the opportunities for advancement to executive positions are excellent.

Casing Out. This work consists in making up orders for shipment. The worker counts out the desired number of shoes of different sizes and lays them in order on the table ready to be packed in cases. The worker must walk back and forth from one table to another and carry frequently two or three dozen shoes in his arms at one time. While the work is not considered heavy, it requires able-bodied men to do it efficiently. Wages average from $20 to $22 a week for an eight-hour day.

Packing Cases. Many grades of shoes are packed in small cartons which hold one pair each; others are wrapped in paper; while others of lower grade are packed loose in large wooden cases. For the most part, the work of packing the shoes in cartons is done by women while the cartons themselves are put in the cases by men. The work of packing the cases varies so greatly that it is undesirable for handicapped men, though now and then an exceptional person who has lost a leg below the knee has done efficient work at this operation. It takes the average person about two weeks to learn to do this work well, and wages average about $22 a week for an eight-hour day.

Making Mackintoshes

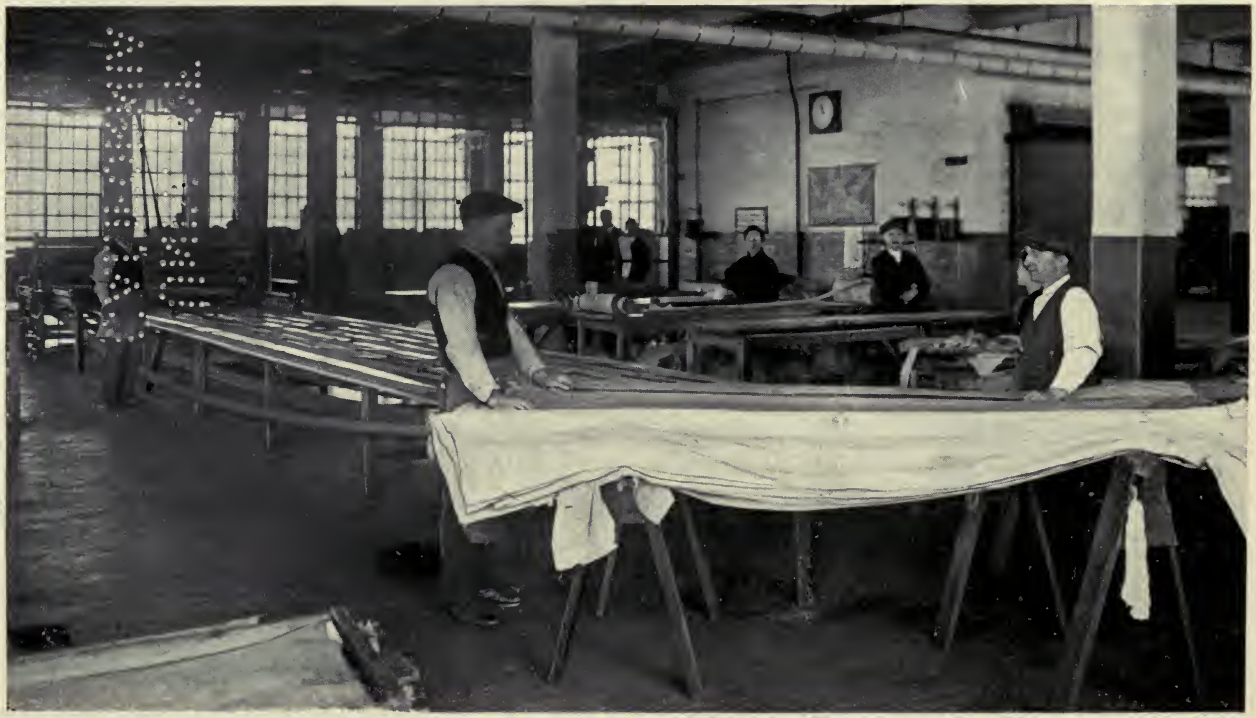
Stitching Cloth. The cloth to be prepared for making mackintoshes is brought to the stitching room where

Courtesy, Hood Rubber Co.

Boot making by the team work method. (*See page 41*)

Courtesy, Hood Rubber Co.

Shipping rubber footwear. (*See page 48*)



Courtesy, Fisk Rubber Co., Chicopee Falls, Mass.

Cutting duck on the bias for making casings

The shears in the background cut the duck which is carried by the endless belt to the bookers in the foreground men turn out strips from 300 to 500 yards in length. The work is all done on sewing machines with special equipment so that the seams are trimmed as they are sewed. As the work is done while the operator is seated, a man who had lost a leg or had received other injuries to the lower extremities could do the work with full efficiency. The worker would need the use of both hands although the loss of one or two fingers would not incapacitate him. Wages range from $18 to $20 a week for a nine and three-quarters hour day. Opportunities for advancement to other work are not very pronounced but men who are wide awake may often be promoted to positions which pay better salaries.

Winding Machine. After the cloth has been stitched, it goes to a winding machine which rolls it smoothly on a mandrel eventually to be used on the spreading machine. The winding machine is very simple, consisting of a wooden frame about five feet high with a platform at the top about four feet square. Rollers are so arranged that the cloth is carried up the frame, across the platform, down to a roller at the bottom of the frame and from there to a mandrel which works in adjustable slots, that allow for play as the roll of cloth increases in size on the mandrel. The mandrel rests on top of two rollers, the function of which is to keep the cloth smooth and taut as it is being rolled up. The machine requires two operators and, aside from the lifting of the rolls, the work is very light. A man with a stump of a hand or with an artificial leg, provided he had a proper appliance, would be able to fit in with an able-bodied man in operating this machine. Wages average about $3 a day.

Spreading Machine. The spreader is built somewhat on the lines of a calender but instead of two rolls there is one roll and a spreader knife. The knife sets above and a little to the back of the center of the roll. Soft rubber is fed to the roll and as the cloth passes between the roll and the knife a coat of the desired thickness is spread over the cloth. On the old-style spreader there is a long platform back of the machine made of pipes which are heated by steam. As a rule, the platform is about four feet wide and from twelve to fifteen feet long. The function of the steam pipes is to dry the rubber so that the material can be handled without difficulty. One man operates the machine and must have two good hands in order to handle the soft rubber. In addition to operating the machine the man handles large tubs of cement. Lifting these tubs is heavy work and could not be done by men who have trunk injuries or hernia. Some foremen are of the opinion that a man who had lost a leg below the knee could, with a suitable appliance, do a full day's work. It requires from two to four weeks for a person to become competent in operating this machine. Wages average about $22 per week at the present time.

Starching Machine. Material for single texture garments is starched before being cured. For this purpose a starching machine is used. It consists of a starch box with a roller at the top and one at the bottom and a brush box, containing a number of roller brushes. The material runs through the starch box where it is completely covered with starch. From here it goes to the brush box where the starch is spread by brushes. Operating this machine is very light work and could be done by one who had lost a leg, provided he had an appliance which would enable him to walk about considerably.

Black Dusting Machine. Material used in making campers' outfits is run through a machine that dusts a black preparation over the rubber coating. This machine is very similar to the starch machine and is operated in practically the same way.

Doubler Machine. After the cloth has been coated with rubber it is put through a doubler machine which takes two coated strips and presses them into a double sheet with the coated sides turned in. Rollers are arranged to smooth out all wrinkles and leave the two plies so that they appear as one. The operator receives $22.50 per week, while the helper receives $20 to $21. The men must handle rolls which weigh from 200 to 300 pounds and move about considerably in operating the machine. It is possible that a man who had lost a leg could help to good advantage on this work, while the loss of one or two fingers would not be a handicap.

Special Curing. Material for mackintoshes is put through what is usually spoken of as a special curing process. The curing room is fitted with racks running the full length of the room and about ten feet high. The material is folded over these racks and hangs down on both sides, almost to the floor. About 300 yards is placed on one rack and about 2,000 yards in one heat. After the material comes from the curing room it is ready for the making department.

Laying Out and Marking Material. The prepared cloth is laid out on a long table and the patterns for the various parts of the coat are marked out. In most shops men do this work. Sometimes those who lay out and mark the material take turns with operators of electric cutting machines but this is not true in all plants. There is nothing about the work that could not be done by men who had lost three fingers or less on either hand. Defective hearing, hernia, weak lungs, or heart disease would not incapacitate one. Wages at the present time range from $25 to $30 per week.

Electric Cutting Machines. These machines are exactly like those described in connection with cutting material for the making of shoes and the work here is, on the whole, of the same nature as that done in footwear plants.

Stitching. The garments are sewed rather than cemented and the work is done on regular sewing machines. Though women do most of the work, men are employed in many plants. The operation allows one to be seated and is, therefore, suitable to men with hernia, an artificial leg, ankylosis of the feet or legs, or slight trunk injuries. Two good hands are required for holding the cloth under the machine but the loss of one or two fingers except the first finger, on either hand, would not be a serious handicap. The wages range from $19 to $22 a week for a nine-hour day.

Strapping. Strapping consists in cementing strips of prepared fabric around the edges of the pockets and over the various seams of the garments. In the Apsley plant at Hudson, Mass., a man who has lost his right leg a few inches below the hip is doing this work with perfect satisfaction. The work can be done while the operator is seated and offers suitable opportunities for men who have had experience in the manufacture of rubber clothing.

Making Gum Coats

The material for gum coats is prepared on calender machines rather than on spreaders. Sometimes for special orders, the material is frictioned and then coated but, as a rule, only the latter process is used. The calenders are very similar to those described in connection with the manufacture of shoes and needs no further mention here. From the calender room the material goes to the cutting room where the various parts are cut out, some by hand and some by electric cutting machines. Gum coats are cemented rather than sewed.

Cementing. The work of cementing is done at tables and requires considerable walking on the part of the worker. The principal tools used are the following: a metal roller, a rubber roller, a straight-edge, and an arm scye. The straight-edge, which is a piece of metal about three inches wide and twelve inches long, is used to make straight lines in putting on the cement. The arm scye is a round block of wood about ten inches in diameter and about eight and one-half inches high. The top end is made rounding so as to fit the opening for the sleeve.

There are many different styles of gum coats and the number of parts varies with the styles, though the operations are all about the same.

The loss of one or two fingers would not interfere with regular work. Men with slight trunk injuries, heart disease, or well controlled hernia could do the work without much difficulty. At the present time, about three-fourths of the workers are women who receive from $16 to $24 per week.

Curing Gum Coats. Each coat is hung on a hanger made so as to hold the shoulders and the neck of the coat perfectly smooth during the process of curing. The coats are carried into the room and placed in rows so that the air passes among them freely. It takes from three to five and one-half hours with a temperature around 250 degrees Fahrenheit to cure the coats. After the garments come from the curing room, the buckles or buttons, whichever are used, are put on and they are ready to go to the inspector.

Surface Goods

A brief description follows of the processes involved in making rubberized fabric for carriage and automobile tops and similar uses.

Surfacing. The rubber surface is put on surface goods either by a calender or by a spreader. In the case of the calender process, the requirements are the same as those previously suggested.

Mixing Stock for Spreading Surface Goods. The rubber compound, which is spread on the fabric is mixed in large churns several feet in height. These churns are operated by machinery. The workers must see that they are properly supplied with compounds. This involves comparatively heavy lifting so that a man in this department should be able-bodied. The loss of two or three fingers or defective hearing would not necessarily handicap him. Wages are about $20.

Spreading. This work has been described in connection with the operations involved in making mackintoshes.

Embossing. After the fabric has been treated with rubber in the spreaders or calenders, it is passed through an embossing machine. The embosser is similar in construction to the calender but is intended to give a final surface to the material. Where special embossing is desired a roll is placed in the machine which will leave the design on the fabric. The operator of this machine should be able-bodied in most respects although the loss of one or two fingers or defective hearing would not necessarily handicap him. He usually has one or two helpers. One of these men could do without a leg below the knee. The loss of one or two fingers or defective hearing would also not prevent him from doing his work. The operator would require one or two months' experience. His helpers could learn their work in a week or so. Wages for the operator are about $21 a week; for the helpers about $19.

Varnishing. In this machine the fabric after leaving the embosser is again coated with a rubber compound. The operation of this machine involves a fair amount of heavy lifting. Of the four men who do this work it is possible that one could be sufficiently relieved so that an artificial leg below the knee, the loss of fingers, and defective hearing would not be serious handicaps. The operator in charge of the machine should, however, be able-bodied. One or two months' experience would be sufficient for the operator, and a week or two would offer sufficient training for helpers. The operator receives about $21 and the helpers about $19 per week.

Curing. After the varnished surface has been put on the fabric it is hung in a large curing room. This work is combined with varnishing and requires a thoroughly able-bodied man.

Miscellaneous Operations. In connection with the preparation and handling of cloth for piece-work there are a number of minor operations. The cloth must be inspected for quality and undue roughness. It must be carefully measured and wound, and the edges must be drawn out evenly before it goes to the spreader. The operations of inspecting are comparatively light and could be done by a man who had lost a leg below the knee or two or three fingers on one hand or who had defective hearing. Wages for various sorts of inspection range from $10 to $20. In the case of the lower wage, the work is at present done by women. The work of winding and stretching cloth would require able-bodied men with the possible exception of the loss of fingers. It pays about $19 a week.

Medical Rubber Goods

There is a large number of rubber articles used in the treatment of patients and for the comfort of invalids that are classed together under the name of medical goods. For the most part, these goods are made in plants that specialize in this line of manufacture. They may be classified according to the processes involved in their manufacture as follows:

Hand Made Goods

a. Air Goods
- Air Beds
- Bed Pans
- Invalids' Cushions
- Camp Pillows
- Surgeons' Gloves
- Atomizer Bulbs

b. Water Goods
- Ice Water Bags
- Throat Bags
- Spinal Bags
- Water Bottles
- Fountain Syringes
- Urinals

c. Bandages
- Tourniquets
- Bands
- Dental Dams

Machine Made Goods

- Catherters
- Colon Tubes
- Rectal Tubes
- Stomach Tubes
- Syringe Tubing
- Stoppers

Molded Goods

- Water Bottles
- Syringe Tubes
- Marsh Finger Pads
- Nipples
- Atomizer Tubes

Hand Made Goods. There is a large number of medical goods made by hand. They differ greatly in construction but the process of making is practically the same in all the articles. As a typical illustration of the entire class, we will consider the processes involved in making camp pillows, water bottles, and tourniquets.

Camp Pillows. The material for camp pillows is prepared on a spreader. The work is exactly like that described under a discussion of the spreading machine in connection with the manufacture of mackintoshes. The parts are cut by hand to the desired size, which is about twelve inches wide by eighteen inches long. From the cutting tables the material is taken to the tables where the operator makes the pillow. The process of making is very simple. One piece is laid out on the table and a strip of friction tape is cemented across the center. The other piece is then laid on and the edges of this piece are firmly cemented to the edges of the first piece. The friction tape is cemented to both the upper and lower pieces. Its function is to divide the pillow so that, when it is inflated, there will be a low place in the middle of it.

At the present time the work is done mostly by women. It is very light and can be done while the operator is seated at a table, though some of the workers prefer to stand. The only thing that would debar a person who had received serious handicaps from working at this operation is the small wages paid. Women are paid from $11 to $12 per week.

Making Water Bottles. The material for water bottles is cut by dies and taken to the making room where women make the bottles. The edges of the side pieces are cemented together and a strip of rubber about three-quarters of an inch wide is cemented over the seam. Heavy pieces are cemented across the bottom of the bottle and pieces forming the mouth are cemented on the top. Either a piece of hard rubber or metal with threads into which the stopper may be screwed is cemented in the mouth of the water bottle. The operator places two or three bottles side by side in a pan ready to be conveyed to the curing room.

Making Tourniquets. The material for tourniquets is cut on a lathe in strips one and one-half inches wide and about fifty feet long. From the lathe the material goes to a folding and pressing machine which folds the edges over so as to make a double strip three-quarters of an inch wide. The machine consists of a piece of steel with a slot in it which folds the strip so that the edges meet evenly. Back of the folder is a rubber roller which presses the two plies firmly together. Girls operate this machine. From here it goes to the cutting tables where the strips are cut into lengths of about forty inches. The work of cutting is done by men. It is very light and could be done by one who had lost a leg below the knee or who had trunk injuries, defective hearing, rheumatism, or hernia. From the cutting room, it goes to the making room. The only thing that is to be done is the folding of the ends. First, a strip of friction tape is cemented on where the fold comes and then the end is turned over and rolled down with a heavy rubber roller. To make the fold as firm as possible it is stitched with a corrugated steel roller. A chain is inserted in one end and a snap in the other. The purpose of the chain and snap is to fasten the ends of the tourniquet after it has been wrapped around a limb. Wages range from 20 to 22 cents an hour for this work.

Stomach Tubes. As typical of the machine-made goods, the making of stomach tubes will be described. The material for stomach tubes is turned out on seamless tubing machines. This work has been described under the making of mechanical goods. As the tubing comes from the machine, it is in strips about fifty feet long. The next operation is to cut it into the proper lengths. The operator then takes these lengths and places a piece of soft rubber in one end and rolls the end down to a point. The rolling is done on a block with a smooth piece of wood. The rubber tubes are then inserted in glass tubes, the inside of which is the size of the outside of the rubber tubes. Catherters, colon, rectal, and stomach tubes vary in sizes from one sixty-fourth to ten sixty-fourths of an inch in diameter. We often speak of these tubes as being as smooth as glass and it is true because they are molded against glass. After the tube has been inserted in the glass, it is partly filled with water and then inflated with air. As the water is heated, it expands and presses the rubber tubing firmly against the glass tube. A piece of cloth is now tied over the end of the glass tube and the material is ready for curing. After they come from the curing room, the rubber tubes are drawn from the glass tubes. This work is usually done by men as it requires considerable strength to extract the rubber tubes.

Most of the work of making stomach tubes is done while the operator is seated at a table and offers splendid opportunities for men who have lost a leg or who have defective hearing, trunk injuries, or hernia. Girls receive from 20 to 22 cents an hour while men are paid 25 to 33 cents and hour.

Molding Water Bottles. A description of molding water bottles and atomizer tubes will be given as typical of the making of molded goods. The molds used in making water bottles consist of two plates and a form, the shape of the inside of a water bottle. Each plate contains an imprint which is the exact shape of the outside of the water bottle. A piece of rubber is laid over one plate and a form the shape of the inside of the water bottle is placed on the rubber. Another piece of rubber is laid over this and the top plate is fastened on. The mold is now put in a hydraulic press and heated by steam until the rubber parts are molded into one piece.

The work is light and could be done satisfactorily by a man who had lost a leg below the knee, two or three fingers on either hand, or who had slight trunk injuries, defective hearing, or hernia. The greatest drawback is the temperature of the room which is, as a rule, uncomfortable on account of the presence of a number of heated presses. Wages range from $22 to $25 a week.

Molding Atomizer Tubes. Atomizers consist of three parts, the bottle, the rubber bulk, and the rubber fittings. The rubber fittings are first molded and then bent into the desired shape. The work of molding is very similar to that of making water bottles, the only difference being in the shape of the molds. Tubes of different sizes and shapes are made. After they have been molded, they are taken to a table where, by means of heated plates, the tubes are bent into any desired shape. The bending plate is about three inches wide and twelve inches long. There are six or eight holes in it varying in size to fit different tubes. A steam chamber surrounds the holes so that the plate is heated evenly. The work of bending consists in placing the rubber tubing in these holes and, when it has become heated to the proper temperature, bending them by hand into the desired shape. The work is very light and the loss of two or more fingers of the left hand, trunk injuries, hernia, defective hearing, or the loss of a leg either above or below the knee would not incapacitate one.

Mechanical Rubber Goods

Mechanical Rubber Products. The mechanical rubber industry includes the production of the following articles: (1) small press goods (soles, heels, washers, gaskets, valves, small solid tires, small molded mats); (2) jar rubbers; (3) small hose; (4) large hose, including fire and suction hose; (5) friction tape; (6) rubber mats; (7) transmission and conveyor belting; (8) packing (sheet and spiral); (9) roll covering for printing shops, paper mills, etc.; (10) insulated wire and cable; (11) surface goods; (12) leatherette; (13) small brass fittings.

The discussion of surface goods appears in another section of this report, though it is ordinarily classed as belonging to mechanical goods. Leatherette, although not a rubber product, has grown out of surfacing processes and consequently its manufacture is frequently carried on in mechanical rubber plants. The foundry and brass finishing departments supply connections and other attachments for mechanical rubber products, and consequently are frequently found where mechanical rubber goods are made.

At the present time mechanical rubber workers spend nine or ten hours a day in their departments with varying conditions of Saturday afternoon employment. This would make forty-eight to fifty-four hours of work a week. In the case of women employees in certain factories, the working hours per week may be even less than this.

In general, working conditions are good, and in many cases excellent. Many factory buildings are comparatively modern so that lighting and ventilation are equal to those of the average home. In certain departments a small amount of soapstone dust is constantly in the air, though the foremen in these departments stoutly maintain that this does no harm. In fact, one or two of the healthiest looking foremen in the plant have been found in such departments. Certain elements of the work bring special conditions of heat which cannot be completely overcome, and in the case of a few operations, the worker will have to handle wet material.

There is little doubt now that the mechanical rubber industry has not only come to stay, but that it will increase in its scope very markedly within the next few years. An instance of the increasing demand for rubber goods is that of soles and heels, which seem to be gradually and permanently taking the place of leather soles and heels. Consequently, mechanical rubber ought to offer as permanent occupation as any industry after the war. Not only will the occupation be permanent from year to year, but it will also vary only slightly from season to season. The seasonal factor is not entirely eliminated, but it is by no means as prominent as in many other occupations.

The question naturally arises as to the attitude of employers in mechanical rubber factories concerning the hiring and training of disabled men. At present, there seems to be marked unanimity and even enthusiasm among superintendents. They are all willing to give the war cripple an opportunity to make himself self-supporting and self-respecting. One foreman emphatically said, "I would a damned sight rather hire a soldier with one arm than a quitter with eight!" Some of this enthusiasm undoubtedly has grown out of immediate conditions; but on the other hand, manufacturers are beginning to give the problem of rehabilitation careful thought, and have reached their conclusions after careful consideration, not only of their patriotic duty, but also of the economic obligations which will be placed upon them in operating their factories at the close of the war.

SMALL PRESS GOODS

After the rubber is passed through the calender it is ready to be made up into various articles. Some of it leaves the calender in rubber sheets of varying thicknesses and widths. Other rubber is put on fabrics of different kinds and qualities to be used later in manufacture of surfaced goods. The rubber which goes to the small press department may or may not be combined with fabric. Generally, it is to be molded into articles one-eighth of an inch or more in thickness. Some of these articles have been suggested in the early part of this discussion. The making of soles and heels will be taken as a typical process.

The Manufacture of Soles and Heels. Stock is cut to the desired size and dimensions in two ways. It may be cut on a dinking machine from sheet stock, or it may be molded in a tubing machine to the right cross section dimensions and be cut into the proper thickness from long strips. The dinking machine is simply a press. The rubber sheet is placed under the top plate of this machine. A die the desired size and shape is then placed over the stock and the material punched out. The machine is sufficiently large so that a number of soles or heels can be cut without moving the rubber stock. The press is released by foot power. In operating this machine speed is an important factor. The worker must set his die in position and cut the sole or heel without marked interruption. This demands excellent muscular coordination, as a wrong move on his part might cause the loss of fingers or a hand. Any member which might be caught between the upper part of the press and the die would undoubtedly be seriously mangled.

Because of the need of constant activity and care, the worker should be able-bodied. The loss of one or two fingers on either hand would not prove a serious handicap. In some cases foremen seem to be willing to accept a man for this work who had lost a leg below the knee, providing he was sufficiently agile to move about and operate the tread with his other leg. In many factories men learn to operate dinking machines by being helpers at first. As the work involves a certain amount of dexterity, two or three months would be required for the average man to become efficient. The wages vary from $20 to $25 a week for piece-work.

Where washers or circular gaskets are too large to be cut on the dinking machine, they are cut on a machine which is constructed somewhat similar to a drill press except that a knife set at the desired radius revolves about the central spindle. This machine is generally used for cutting washers over nine inches in diameter. In general, the stock which is handled in this machine is comparatively heavy, though otherwise the work is light. The loss of not more than two fingers on one or both hands, loss of a leg below the knee, slight stiffness of the knee or hip joints in one leg, or defective hearing, ought not to disqualify the worker providing he could devote all his time to this type of work. The wages paid here are about the same as those received on a dinking machine.

Tubing Machine. The tubing machine is used with certain variations in a number of processes in the mechanical rubber industry. In the case of manufacturing heels, the heel rubber is run out in lengths of about thirty-six inches and then cut up into heel widths. The machine in its general construction is very similar to the common meat grinder in a butcher shop. Instead of feeding meat into the hopper at the top, rubber is forced into it. The rubber comes out at the side in various sizes and forms according to the die which is placed on the tubing machine. Dies may be interchanged for various sorts of work. Three men generally operate the tubing machine, though in some cases four or five may be employed. One man acts as operator and the rest as helpers. The duties of the operator vary slightly in different plants. In some cases they are such that the man could get along with an artificial leg below the knee. Loss of fingers or of a hand or arm below the elbow might not prove insurmountable handicaps in some factories. Stiffness of any joint in one leg, or of the elbow joint in one arm, or slightly defective hearing ought not to completely incapacitate an operator. What is true of the operator is equally true of the helpers with regard to injuries, providing that at one machine there is not more than one disabled man. In this work the operator must understand the heats required in a tubing machine to make the rubber desirably pliable. Necessary familiarity with heats or desirable temperatures may be acquired in two or three months. The helpers could very well learn their work in a few days. The wages range from $19 to $25, in various factories, the lower figures being those for helpers.

Vulcanizing. The molds for small press goods are generally from twelve to twenty-four inches square. They are made in two halves and contain the number of impressions of desired dimensions. The stock which has already been cut to approximately the size is placed in the mold and the two halves put together. The mold is then placed in a hydraulic press, where under the influence of heat and pressure, the rubber is cured. In the curing process the rubber stock fills out the mold.

Most of the molds are comparatively heavy, and as the worker stands directly in front of his press there is considerable heat. The loss of one or two fingers or defective hearing seem to be the only disabilities feasible in this sort of work. However, if arrangements could be made for one man to handle the lighter presses, the loss of a leg or even a hand or of an arm below the elbow might not seriously handicap him. The operation of a small press could be learned in three weeks' time. The wages range from $20 to $30, and even in pre-war times small press work was comparatively well paid. In discussing the operation of small presses, the making of heels and soles has been selected as a characteristic example, though a large variety of small rubber articles are made in this way.

Trimming. After the soles and heels have been removed from the press there are little edges remaining on them where the rubber has been forced out over the face of the mold. This must be trimmed off. Practically all of the trimming is now done by girls and women. Some is done by hand and some is done on a small machine where circular knives revolve rapidly. As trimming is a somewhat minor operation, it must be done very rapidly in order to keep the cost down. For this reason girls seem to be better adapted to the work than men. However, the work is extremely light and is done while the worker is seated. The loss of both legs, hernia, stiffness of the trunk muscles, stiffness of joints below the hips, or defective hearing, would probably not prove serious handicaps. The only training involved is that required to develop speed. The wages are about $15 per week for women, and it is probable that they could not be raised for men unless they did a greater amount of work.

Inspection and Packing. All soles and heels are inspected after they have been trimmed before they are packed in boxes in which they are to be shipped. Both the inspection and packing are done by girls, who receive an average of $13 a week. This work is very similar in its requirements to the trimming, and the disabilities are practically the same.

Summary. Small Press Goods. This department varies in size in various factories, though it is apt to be comparatively large, employing from seventy to one hundred people, of whom probably forty per cent. are women. The men are chiefly Americans, Poles, and Italians. With the exception of the press work, working conditions are generally very comfortable. In the case of the press operators there seems to be a consensus of opinion that the men become accustomed to the heat in a comparatively short time.

JAR RUBBERS

The Making of Jar Rubbers. The rubber is molded by running it through a tubing machine in the manner already described. The rubber is cut into lengths of about thirty-four inches after it leaves the tubing machine. These strips are placed on a metal mandrel or rod and are ready for curing. In a typical case of operating this tubing machine, one man feeds the rubber into the machine, the second cuts the tubing into strips, while a third operator puts the strips on a mandrel. The fourth man loads the mandrels of the rubber tubing on small wheel trucks. The feeder might have any of the disabilities already mentioned in connection with feeding the tubing machine in the manufacture of rubber heels. The man who cuts the strips could work with the loss of one leg, either above or below the knee, and the loss of fingers on one hand, the loss of a hand or one arm below the elbow. Neither hernia nor defective hearing would prove serious handicaps. The other two helpers who handle the mandrels would need to be fairly able-bodied. Loss of one or two fingers or defective hearing would not seriously handicap them. The length of time required for the feeder to learn the work would be the same as that suggested in connection with the making of rubber heels. Helpers on the machine could learn their work in a few days' time. The wages for this work are about $19 or $20 a week.

Curing. After the jar ring tubes have been placed on the mandrel they are taken to a vulcanizer, which has a cylindrical chamber sufficiently large to accommodate trucks such as are used in factories. Some of these chambers are fifty feet in length and six or eight feet in diameter. Where there are only one or two vulcanizers in the department, their operation does not require the entire time of one man. After they have been filled and sealed there is no work connected with operating them except to see that the required temperature is maintained and that the rubber remains in them the desired length of time. Where a number of these vulcanizers are run together the heats could be cared for by a man with certain disabilities, providing the operation of the doors was not one of his duties. Loss of fingers or of a hand or arm either above or below the elbow, stiffness of joints in one arm or one leg, or trunk injuries or defective hearing would not prevent a man from caring for heats. Familiarity with heats and rubber would be a prerequisite in this work, so that two or three months' experience would be expected before the vulcanizers could be trusted to an operator. The wages are about $19 a week.

Stripping. This work consists in blowing the tube off the metal mandrel after it has been taken from the vulcanizer. The work is comparatively heavy, so that loss of not more than three fingers on one hand, slightly defective sight or hearing would be the only possible handicaps. The work can be learned in a comparatively short time. The wages are about $19 a week.

Jar Ring Stock Room. Jar ring stock after curing is stored until it is needed for cutting into rings. This work is comparatively light. Loss of fingers, of a hand or arm, or slightly defective hearing would not prove serious handicaps. The man who does this work, however, needs to have a common school education. The wages are about $19.

Blowing On. When the cured tube is to be cut into jar rings, it is blown on a mandrel with the assistance of compressed air. This second mandrel is wound with tape so that cutting knives will not come in contact with the metal. The operation of blowing on is combined with that of stripping. Loss of fingers or a leg below the knee, stiffness of any joint in one leg, or defective hearing would not bar the worker either in blowing on or in stripping. It is also possible that slight stiffness of the body muscles would not prove a serious hindrance to workmen in either of these operations. As this work involves a certain dexterity in handling the compressed air mechanism, it would require three or four weeks before the worker could make satisfactory speed. The wages are about $19 a week.

Cutting Jar Rings. After the tube has been blown on, the tape-wound mandrel is placed between the centers of a lathe. The carriage of this lathe carries from two to four circular knives which are automatically lifted and dropped on the tube as the carriage travels along its length. In this way the rings are cut to the required thickness. One lathe operator generally has two or three machines under his direction. After he has learned to place his mandrel properly between the centers, little more is demanded of him in the way of training. The knives are generally set by some one else and the machine stops automatically when the jar rings are cut. Although this work does not require any great amount of skill, men are apt to be advanced to it who have been blowing on or stripping tubing. This is probably due to the fact that the work is more attractive. The loss of a leg below the knee, providing this loss does not interfere with standing or moving from one machine to another, would not prevent one from doing this work. Loss of two or three fingers on one hand, or stiffness of the knee joint in one leg, or defective hearing, or slight stiffness of the trunk would also not be serious handicaps. Wages are about $19 a week.

Breaking Jar Rings. After the jar rings are removed from the mandrel in the stripping process, they are put into a machine which pulls them apart. The work is comparatively light, and disabilities for operating this machine are the same as for cutting jar rings.

Covering Mandrels with Tape. As the knives which cut the jar rings pass through into the tape on the mandrel, it is necessary from time to time to rewind the mandrel. Unless the output of jar rings is exceedingly large, this work does not offer full-time employment for one man. It is, however, attractive for men with certain disabilities and could probably be combined with other employment of similar character. A mandrel is placed between the centers of the lathe and the tape is wound on very tightly. When, approximately, the right diameter is obtained, the tape is trimmed on a lathe so that the tubing will fit snugly over it. This work could be done by any one with the disabilities specified for cutting jar rings. A little longer training, however, would be required. The salary, when this work was done continuously, would be practically the same as that for cutting the rings.

Counting and Packing Jar Rings. Jar rings are counted by hand, as no satisfactory mechanical device has yet been perfected for doing this work. The folding and sealing of boxes, which hold a dozen jar rings, is done either mechanically or by hand. Practically all of this work is at present done by girls. It requires rapid manipulation, though the operator may be seated. The work would probably be undesirable for men, as wages are small on a piece-work basis. The wages range from $10 to $15.

Sealing and Shipping Boxes. After the jar rings are packed in gross boxes, they are ready to be put into shipping boxes which are made of corrugated cardboard. The upper cover of the shipping boxes is fastened down by the worker who also handles boxes. This, therefore, is comparatively heavy work. Loss of fingers or defective hearing would not prove serious handicaps. The work can be learned in a few days. Wages are $18 or $19 a week.

SMALL HOSE

Included under small hose are all hose of relatively small diameter which do not have to stand unusually high pressure. Among the hose in this class are garden and gas hose. Hose of this grade is generally a combination of rubber and fabric put together in different ways. It may be divided roughly into hand-made, braided, and molded hose.

Hand-Made Hose. The production of hand-made hose can be divided roughly into two parts, the making of the rubber tube and the building up of the fabric and rubber outer casing.

Making of Rubber Tube. The inner surface of small hose is generally rubber. This is made in the form of a tube on the tubing machine. The operation of the tubing machine has already been discussed. As the tube is taken from the machine, it is wound in a tray and dusted with soapstone. The tubing is next cut into desired lengths, generally fifty feet, and is blown on a mandrel. The blowing on process, as has already been suggested, consists of expanding the tube slightly with the assistance of compressed air so that it can be readily drawn over the mandrel. Even in the case of the smaller tubes this work is generally heavy, as it involves the handling of the fifty-foot lengths of metal over which the tubing is drawn. Consequently, the worker would need to be able-bodied, with the exception of possible loss of two or three fingers on one hand, or defective hearing. Two or three weeks would be sufficient time to become familiar with blowing on. Wages are about $21 per week.

Making-Up. After the tubing has been blown on the mandrel, it goes to the making-up department. The work in this department is done at tables sufficiently long to accommodate fifty-foot lengths of hose. The operations here vary considerably in different factories. In some factories the entire work of making-up is done at a single table, whereas in others the different operations have been segregated, so that one man is constantly employed in a single operation. The latter scheme seems to be the more desirable from the standpoint of factory efficiency. The objection that the work becomes monotonous could be overcome by shifting the men from time to time from one operation to another where this would seem advantageous.

In discussing the process of making-up, the operations will be treated separately; though, as they require practically the same physical abilities, the discussion would apply equally well in factories where they are combined.

When the rubber center reaches the making-up department, it is first wound with duck after being cemented. This duck middle is made by cutting duck strips previously treated with rubber in the calender department. These strips are cut and pieced together on the bias in order to give greater strength to the hose. The cutting is done by hand or by machinery. In the case of cutting by hand, the operator working at a long table cuts the duck as it comes from the roll. He must work rapidly and at the same time accurately. The strips which he cuts are taken by the blocker, who pieces them together in a long strip four or more inches in width, according to the number of plies desired. The strip is then wound on rolls by a helper, and in some cases the helper also assists in handling the stock at the table. The work of cutting requires activity both of legs and arms. Loss of two or three fingers, heart disease, hernia, or defective hearing would not necessarily handicap the cutter. Practically the same disabilities apply to the blocker and helper. Inasmuch as the cutter must work rapidly, it requires one or two months' experience in order to reach a desirable degree of efficiency. The blocker could pick up his work in a week's time and the helper in a few days. In cutting the stock by machinery, the fabric passes under a long blade from four to six or eight feet in length which operates mechanically in the same manner as the common paper cutter. The work is similar in other respects to hand cutting, and involves the same disabilities. Cutters receive $22 to $25, blockers about $15, and helpers, who are generally boys, about $12 a week.

After the duck has been cut and blocked, it is sent to the making-up room. In some factories this is simply a matter of carrying; in others mechanical devices have been installed by which the duck is carried by an apron, or some similar device, to the making-up table. Where the apron conveyor is used, one or two helpers are required for its operation, which is comparatively light work. At least one of the helpers could work with the loss of a leg either above or below the knee, loss of fingers, hand or arm, hernia, stiffness of joints in one leg or one arm, or defective hearing. In some cases girls are doing a portion of this work. Experience of a day or two would be sufficient training. The wages range from $12 to $20 according to the operation.

The first operation in making-up is rolling on of the duck middle. One edge of the duck is fastened to the tube, and rolling on is accomplished by placing the tube with the duck between three revolving rolls which wind the duck tightly and smoothly about the tube. In some cases this operation is divided into two parts: (1) fastening the duck edge to the tube; (2) rolling the duck on the tube. The rubber cover is wound about the duck middle in a similar fashion at another table. The cementing of the tube before the duck middle is put on is sometimes done at a separate table also. After the rubber cover has been put on, the hose is ready to be cured. Before it is placed in the curing oven it must be wound with a moist cloth. In the case of smaller hose the cloth may be wound on after the fashion of the duck middle and rubber cover. In the case of larger hose, the cloth comes in strips of a few inches' width and this is wound on in overlapping, spiral form. The object of wrapping is to have the strong, firm pressure on the outside of the hose so that it will not expand unevenly or to too great extent. From the wrapping table the hose is placed on a truck, which is run into the curing oven.

Vulcanizing. What has previously been said of the care of vulcanizers applies equally in the case of hose vulcanizers. Where a number of these are grouped together, a disabled man could have charge of all of them. These vulcanizers are similar in shape and general dimensions to the vulcanizers used for curing jar rubbers.

Stripping. After the hose has been cured, the fabric wrapping is removed. This is comparatively heavy work as it involves handling the hose. With the exception of loss of two or three fingers or defective hearing the worker should be able-bodied. The work could be learned in one or two weeks. The wages are $20 to $25 per week.

Blowing Off. The hose is next removed from the mandrel. This is done by again expanding it by compressed air and drawing it off. The work is comparatively heavy and requires an active man in good general physical condition. There is considerable noise in this work resulting from the compressed air working around in the hose. With the exception of loss of two or three fingers on one hand, or defective hearing, the workers should be generally sound. The wages are between $20 and $25 a week.

Preparation for Shipping. In connection with this work there are two or three minor operations. One consists of drawing the hose out at full length preparatory to rolling it up. Another consists of trimming the hose ends and attaching couplings. A third consists of winding and inspecting the hose. Wages here range from $16.50 to $21. The straightening out of the hose could be done by a man who had lost one hand, or one arm either below or above the elbow. The work involves considerable activity in the legs and trunk, so that injuries to either would disqualify the worker. No training is required for this task. Attaching couplings is done by a semi-mechanical process. The worker might have lost two or three fingers of one hand, but with the exception of defective hearing should be able-bodied in other respects. Inspecting requires a general knowledge of the process of manufacture and familiarity with various qualities of rubber. The work is comparatively heavy, so that the physical requirements are the same as for putting on couplings.

Molded Hose. Where it is desirable to obtain unusual lengths of hose without joints, it is not practicable to make the hose by the method just described. It is necessary to use a device by which the hose can be cured in any length. This device is a very large press which is grooved to the same diameter as that of the hose. In some of these presses the grooves run lengthwise; in others the press is circular in form and the grooves form a spiral. The upper plate of the press is exceedingly heavy and is lifted either hydraulically or with the assistance of a chain fall.

Making of Molded Hose. Instead of building the hose in the manner previously suggested, the duck middle is braided around the tube. The various plies of duck are put on separately, each ply having a thin coating of rubber between it and the next. These thin coatings are put on by running the hose through the tubing machine, and of course the outer rubber cover is put on in the same manner. The operation of the tubing machine is similar to that already described. The machine itself is slightly different, inasmuch as it permits the hose which is to be coated to pass through it from one side to the other.

Braiding. The braided middle for this hose is put on in looms. The hose passes up through the center of the loom and the braid is put on by a system of spools of cotton thread which follow a crossing, zigzag course around a circular table. The operation of these looms is largely given to women. It requires a fair amount of activity, though loss of two or three fingers on one hand, hernia, or defective hearing would not prove serious handicaps. Wages at present are about $14 a week.

Vulcanizing. The general construction of the vulcanizer for molded hose has already been described. In the case of the rectangular vulcanizer the hose runs from one mold groove to another in a loop which projects beyond the mold. This demands a second curing in which the section of the hose not included in the first curing is placed in the mold. The interior diameter of the hose is maintained throughout the curing process by air pressure. In the case of the circular mold the entire length of hose may be cured at one time. The operation of these presses requires an able-bodied man, though the loss of thumb or one or two fingers, or defective hearing, would not prove serious difficulties. Wages average $20 a week.

Braided Hose. The process of the operations in making the braided hose has already been discussed under molded hose. The braid is built up in the manner suggested in that discussion. The curing, however, is not always done in a mold. The hose may be wrapped and cured in an oven rather than a mold vulcanizer.

LARGE HOSE

Under this heading is included fire hose, air-brake hose, vacuum hose, and suction hose. Most of these hose are made by hand.

FIRE HOSE

Cutting Stock. Fire hose is made by hand. In some instances, the inside rubber tube may be made on the tubing machine. This process is the same as that described in connection with other hose-making, except that a larger die is used in the tubing machine. Most of the tubes for fire hose, however, are made by hand. The rubber stock for the tube comes from a calender. It is laid out on long tables in fifty-foot lengths. The stock, as it leaves the calender, is about a yard in width. This must be cut into strips equal in width to the circumference of the hose. The edges of the strips are cut on a bias, so that when a strip is folded over to form the tube, there will be no rough joints. Two or three men work together on the cutting tables. Their work consists of laying out the strips and cutting them with a sharp jackknife. They must move from one end of the table to the other with considerable rapidity. An experienced cutter follows the line with his knife as rapidly as he can walk. The loss of a leg would therefore disqualify one for this occupation. The loss of one or two fingers on either hand, however, would be no serious handicap, providing the man could hold a knife firmly. In some cases, employers seem willing to try a worker who has lost a hand or arm, providing he has sufficient strength and dexterity in the other member. Heart disease, hernia, or defective hearing would not prevent one from cutting. Trunk injuries, however, or stiffness of important joints would prevent the necessary amount of flexibility of body. It would require one or two months' training to become efficient in this work. The wages are about $25 per week.

Making Tubes. After the strips have been cut, one surface is sprinkled with soapstone. A board the length of the desired tube and the proper width and thickness is then generally laid along the center of the strip. Over this the strip is folded and the edges brought together and held with cement. This work is called 'butting on'. After the edges have been drawn together they are firmly rolled in place and the tube is ready to be semi-cured. The work of butting on and rolling edges is very similar to that of cutting, except that the operator does not have to move as rapidly along his table. The disabilities for this work are similar to those for cutting, except that the worker would need both his hands unless an extraordinarily well-designed appliance could be fitted to a stump arm to assist in folding the edges together. The loss of a leg below the knee, as in the case of cutting, would not be a serious handicap. This operation would require about a month's training. Wages for this work range from $21 to $25 a week.

Semi-Curing. After the tubes have been made they are laid out in long pans. These pans are put into a vulcanizer and the tube is semi-cured. This work is generally done by men from the cutting and making-up tables, or by other helpers in the department. Unless the making of hose were done on a very large scale, there would probably not be sufficient vulcanizing in this department to require the entire time of one man, so that the recommendations previously given for the care of a group of vulcanizers would not apply here.

Backing Tubes. In order that the tube shall adhere firmly to the cotton cover after the final curing, it is wrapped with a layer of gummed rubber after the semi-curing. This work is done at long tables in a manner similar to making-up. The disabilities in this work would be practically the same as those permissible in making-up. The wages are about $18 a week.

Spooling Cotton. The rubber inside and the cotton cover of fire hose are made separately. The making of the rubber inside has already been described. The cotton thread which goes to make up the fire hose comes in large spools. It is necessary to wind some of this cotton on smaller spools. This work is done at a machine somewhat similar to a lathe. In some factories this work requires the entire time of one man. The loss of a leg above or below the knee would not prevent one from working here, as arrangements could probably be made for the man to be seated a portion of the time. Loss of two or three fingers on one hand, hernia, stiffness of the knee joints in one leg, or slight stiffness of the trunk, or defective hearing would also not unduly handicap the worker. A week's time would offer sufficient training. Wages are $18 or $20.

Weaving Hose Fabric. The weaving of hose fabric is somewhat similar to braiding, except that there is a warp and woof in the fabric. Furthermore, in the case of most hose the cotton jacket is not woven directly on the hose. Instead of having the bobbins moving in and out, two series of threads are alternately raised and lowered while a pair of bobbins pass between them. This operation reminds one of the making of carpets or of similar material. Most of the looms for weaving large hose covers are operated by women. In a few cases there are men operators. The loss of two or three fingers on one hand, or the loss of a hand, or arm below the elbow, stiffness of wrist joint in one hand, hernia, or defective hearing would not prevent one from doing this work. Wages are $18 or $20 a week for men.

Twisting Cotton into Plies. In the making of the heavier hose covers, it is necessary to have the cotton in several plies. The devices for twisting the cotton vary somewhat. In a machine that is commonly used, the thread comes from the desired number of spools and passes through a series of holes in a revolving disk. This disk twists the cotton into a single thread which is rewound on a spool on the opposite side of the disk. In some factories these machines are operated by men; in others by women. The work is not heavy. It consists largely in seeing that the spools are not allowed to run out and that breaks in threads are mended at once. The loss of fingers on one hand, the loss of a hand or arm above or below the elbow, or the loss of a leg above or below the knee, stiff joints in one arm or leg, hernia, or stiffness of trunk muscles would not prevent one from doing this work on certain types of machines. There is nothing in the work itself which would be undesirable for a man with slight nervous disorders. However, the machinery makes a certain amount of noise, and in some factories the work is done in the weaving room where the looms are exceedingly noisy. The work can easily be learned in a week's time. The wages are about $18 a week.

Inspecting and Winding Hose Fabric. As the hose fabric comes from the looms it is cut into lengths somewhat under fifty feet. In some cases this length is about forty-eight feet, though it varies with different qualities and sizes of hose. It is taken to the inspecting table where any faults in the weaving are detected. The worker here also winds the hose fabric in a roll before it leaves him. The loss of fingers on one hand, the loss of a hand, or arm below the elbow, or a leg below the knee, stiffness of elbow joint in one arm, or any joint in one leg, or slight stiffness of trunk muscles, hernia, or defective hearing would not prevent one from doing this work. The work itself requires care and familiarity with the varieties of material inspected. The disabled man should, therefore, have perfect eyesight and good muscular and mental control. The work itself would require two or three months' training. The wages are $18 to $20 a week.

Stretching Hose Fabric. In order that the fabric shall not stretch after it is made into the hose, it is cut in lengths less than those desired and stretched before the tube is drawn through. In the case of the forty-eight-foot length, the hose is drawn out to fifty feet. This work is done by running a hose through a roll machine which gives the desired amount of tension. The loss of a leg below the knee, loss of two or three fingers on one hand, hernia, or defective hearing would not prevent a man from doing this work. A week's time would offer sufficient training. The wages are from $18 to $20 a week.

Drawing On. After the backing has been placed on the rubber tube, it is ready to have the cotton cover drawn on. This work is done at a long table. A rope is drawn through the cotton cover and one end attached to the tube. The tube is then drawn through with the assistance of mechanical tubes which wind in the rope. This work requires two men. One of these men should be able-bodied. The second, however, could get along with the loss of a leg below the knee, loss of two or three fingers on one hand, or defective hearing. A week's time would offer sufficient training for either man. The wages are about $20 a week. The hose is now ready for the final curing. It is not, however, placed in a vulcanizer, as is customary in most operations of curing. The ends of the hose are clamped to iron nozzles which are connected with the steam system. Steam is then allowed to fill the hose, and in this way the curing is done. The work is moderately heavy, as the clamping of the hose ends must be firm, though the loss of a leg below the knee would not incapacitate one of the workers. The loss of two or three fingers on a hand or defective hearing would not be serious handicaps to either worker. The routine of the work could be learned in a few days. Wages are about $21 a week.

Winding Hose. After the hose is cured it is wound in a roll. This winding is done over a drum. In some factories it would offer full-time employment for one man, but it is not difficult and could be learned easily in a day. Loss of fingers on one hand, loss of a hand, or arm below the elbow, stiffness of wrist joints in one hand would not seriously interfere with this operation. The wages are about $18 a week.

Fastening Couplings. As in the case of small hose, couplings are fastened to either end of the hose before it is shipped. This is done with the assistance of a mechanical device, which forces the hose against the coupling by expanding an inside collar. The loss of two or three fingers on one hand, or of a leg below the knee, hernia, or defective hearing would not prevent a man from doing this work. One or two days would be sufficient for acquiring familiarity with this operation. The wages are about $20 a week.

Feeding Rubber Tubes into Elevated Looms. Where the cotton jacket is woven directly around the rubber tube, the tube passes up through the center of the loom. Some factories place these looms on a platform elevated six or eight feet above the floor of the plant. This permits the easy manipulation of the rubber tubing. The feeding of this tubing to the loom in some cases requires the entire time of a man. The work is not particularly arduous. It simply involves keeping the tubing from tangling, etc. There is a certain amount of lifting and handling of tubes. The loss of a leg below the knee, loss of fingers or of an arm below the elbow, or defective hearing would not disqualify a worker in this operation. Wages are about $18 a week.

Suction Hose. Suction hose must be made with exceeding care, as it is required to stand high pressures and general rough treatment. The work is done entirely by hand and resembles in some respects the operation of roll covering, to be described later.

Duck Building. In some cases, the ends of suction hose are especially reinforced, so that the coupling joints will be strong. This reinforcing is called 'duck building'. At either end of the mandrel, on which the hose is to be built, is wound a small amount of friction cloth, thus giving extra strength at the extremities. This is a minor operation and does not require the entire time of one man. He is employed a portion of the time in stripping or similar work, so that disabilities which apply to stripping will apply equally here. The salary is about $21 a week.

Butting On. After the ends of the hose have been reinforced, the inner rubber tube is put on the mandrel. This consists of a long strip of rubber cut in width equal to the inside diameter of the hose. The work is done at a long table and consists of rolling the rubber strip over the mandrel and fastening the edges firmly together. The work involves considerable moving about, and the operator would need both hands. Loss of two or three fingers on one hand, however, heart trouble, hernia, or defective hearing would not seriously interfere with his doing this work. One or two months' time would be required to gain desirable familiarity with the operation. The wages are about $21 a week.

Winding on Wire. In order to give unusual strength to the hose, it is often wound with heavy wire. The mandrel is placed between the centers of a lathe and revolved. The wire is guided along the length of the tube by the carriage. Space of a half an inch or more is left between the strands of wire as they are spiraled around the hose. In some cases the wire is put on before the final covering, while in others it is put on over this covering. The work demands an able-bodied man. However, loss of two or three fingers on one hand, hernia, or defective hearing would not seriously handicap him. The wages are about $20 a week.

Stringing Hose. In some instances, hose is wound with heavy string in a manner similar to that employed in winding with wire. This also is done in order to give unusual strength to the hose. The operation is similar to the one just described and involves the same disabilities. Where a helper is employed, his wages are $19; while those for the operator are about $21 a week.

Making Hose. With the exception of the points noted, the heavier hose is made in a manner similar to that described under the heading, 'Hand-Made Hose'. Disabilities and wages are about the same.

The operations of wrapping, vulcanizing, stripping, and tying are also similar to those previously described.

Painting. A great deal of the suction hose is painted before it is shipped. This is exceedingly dirty work. The paint is poured out in long troughs and the hose is drawn through it. The workman must keep both his hands in the paint, as he uses them to wipe off the surplus which adheres to the fabric of the hose. With the exception of loss of fingers or defective hearing, he should be able-bodied. The work pays from $18 to $21 a week.

FRICTION TAPE

In making friction tape, it is necessary that the rubber compound be forced into the fabric, and this is accomplished on a calender or spreader by operating the rolls at different speeds, thus working the compound through the duck. This work is similar to other calendering processes as regards disabilities and wages.

Stretching Friction Cloth. In the treatment of friction cloth for certain purposes it is necessary that the edges be drawn out exactly. This work is done in some factories by a mechanical stretcher employing about three men. One of these men could do the work with the loss of a leg, either below or above the knee; hernia or defective hearing would also not be serious handicaps. The other two workers should be able-bodied. The work could be learned in a few weeks in the case of the operator. The helper would require only a few days' training. Wages for the operator are about $22 a week, for the helper about $19.

Cutting Tape. Friction tape is cut into wide or narrow strips after it has been rolled. In the case of the wide tape the outer edges are trimmed off. This is done by revolving the roll against a sharp knife. The loss of a leg below the knee would not prevent one from doing this work. In fact, in one factory visited the operator of this type of cutting machine had for some time worked with an artificial leg. Loss of two or three fingers on one hand or defective hearing would not prove serious handicaps. The wages are about $21 per week.

A great deal of tape is sent out in narrow strips such as one commonly sees for sale in bicycle and automobile supply stores. This tape as it comes from the spreading machine is placed on a mandrel which rests between the centers of a lathe. A tool rests on this lathe which runs the length of the fabric. The bar of the rest is notched at regular intervals according to the width of the tape desired. The operator with the assistance of the notches cuts the tape. This work must be done rapidly. The loss of a leg below the knee or of one or two fingers on one hand, hernia or slight stiffness of the trunk, or defective hearing would not prevent one from doing this work. This operation is not difficult although it would take several weeks to acquire a sufficient amount of speed. Wages are about $22 a week.

Wrapping Narrow Tape. After the tape has been cut into the desired widths it is wrapped in tin foil to prevent drying. This is done either by hand or by an automatic wrapping machine. Most of the work is done by girls. The handicaps for this occupation would be similar to those in cutting. Girls are paid about $12 a week. In the case of the smaller spools of tape the tape is cut and the wrapping machine operated by one man who has charge of both. His work is similar to that described in connection with cutting the tape and the disabilities are the same. Wages are about $20 a week.

RUBBER MATS

A great variety of rubber mats is now being made. They are used for doorstep mats, mats in automobiles, stair mats, and other similar articles. The stock for rubber mats comes from the calenders in rolls. Where a standard form is desired corrugations may be put on in the curing press. In a great number of cases, however, it is necessary to cut perforations by hand.

Slating. Before being sent to the curing press some of the rubber for mats is run through the slating machine which dusts a fine coat on the surface of the rubber. The rubber travels through this machine between rolls arranged with their axes horizontal. This work is comparatively heavy as it involves the handling of rolls of rubber. Loss of fingers or defective hearing would not be serious handicaps. Familiarity with the work could be acquired in a few weeks. The customary wage is about $20 a week.

Cutting Perforations. After passing through the presses, which are generally very heavy, the mats are cut into the desired lengths and are ready to be perforated according to specifications. This work is done by hand. The operator lays out the work and does the cutting with the assistance of a mallet and dies. The work requires a considerable amount of skill and familiarity with the operations of measuring and ruling. Loss of fingers or hearing would not be serious handicaps. It might also be possible for the worker to use an artificial leg below the knee provided he could move around with sufficient agility. Two or three months' experience would be necessary to acquire a satisfactory familiarity with this work. The wages are about $25 a week.

Trimming Mats. In the case of some mats the edges must be trimmed. The work is not difficult; it simply requires the manipulation of a knife. A man with one leg, the loss of one or two fingers on one hand, hernia, stiffness of joint in one ankle or defective hearing would not necessarily handicap the worker. The wages are about $20 a week.

TRANSMISSION BELTING

Cutting Stock. Stock which is used in making transmission belting is cut into the desired widths from the rolls. The cutting is done by a series of knives arranged at desired intervals. The material is fed to these knives by a pair of rolls similar in their arrangement to the rolls on calendering machines. The operator on this machine has charge of setting the knives and seeing that the stock is being properly cut. He usually has one or two helpers who assist in the rewinding of the material after it has been cut into strips. The operator should be able-bodied, with the possible exception of loss of two or three fingers or defective hearing. One of the helpers, however, could do his work with an artificial leg below the knee, loss of two or three fingers on one hand, or defective hearing. Six weeks' experience would be necessary for an operator. A helper could learn his work in a few days. Wages for helpers are about $19; for operators $20 to $25 a week.

Folding. Rubber belting is generally made of two materials, a fabric inside and a rubber cover. The fabric is folded at long tables in the required number of plies. These vary according to the quality and thickness of belt desired. The fabric is hung at one end of the table in a large roll, it is then drawn out and as it is folded it is wound on another roll at the other end of the table. Three or more men are required in this operation. The operator has general charge of the folding and it is his work to inspect the material as it is rewound. The actual folding is done by a 'pull-over' man. In some cases a strip of rubber is laid along the joint in the fold so that during the curing process the fabric becomes practically one piece. Helpers are also required to manipulate the roll. The work of the operator is not excessively heavy. Loss of a leg below the knee, loss of two or three fingers or stiffness of knee joint in one leg would not disqualify him. In the case of the pull-over man there is a possibility that the same disabilities would apply, although the man would have to be unusually active in the use of his artificial limb to do this work. It is not excessively heavy but requires constant, moderate exertion. In the case of one of the helpers the same disabilities would apply provided some arrangement could be made to relieve him of the lifting of rolls, which at the present time he is generally expected to do. The wages for this work at present vary from $19 to $22 a week. The skilled operations on this work could be learned in one or two months. Where folding is done mechanically the belting is turned over by means of rolls placed at different angles on the table. Physical requirements and wages are about the same as for hand folding.

Sewing Belting. After the belting has been folded it is sewed lengthwise at regular intervals across its width. This work is done with a power machine similar to a sewing machine but heavier in construction. In some cases a single stitch is taken at a time, in other cases two stitches.

At the present time the operators of the sewing machines are both men and women. Where women are doing the work they must have a certain amount of assistance in handling the rolls of fabric. Very little knowledge is required to operate these machines beyond knowing how to wind the bobbins which the operators do themselves. Provided arrangements could be made to assist the crippled operator with the slight amount of heavy work necessary, the loss of a leg above or below the knee, the loss of fingers on one hand, hernia, stiffness of knee or hip joints of one leg, or defective hearing would not prevent one from doing this work. The actual operation could be learned in two or three days. The wages are about $19 a week.

Covering Belts with Rubber. After the fabric has been folded and sewed the rubber cover is put on. This rubber comes in the form of sheets which are folded over the fabric and joined along the edges. The rubber has been previously cut to approximately the size desired. This work is similar to cutting of stock for other operations. The work of folding over the cover is done by two men working together at a long table. The operator who directs their work trims off the rough edges and inspects the belting at the same time. A fourth man has charge of the lining about which the rubber has been wound as it came from the calender. The operator in this work requires a certain amount of dexterity and familiarity in trimming the edges. He should be fairly able-bodied, although the loss of two or three fingers on one hand or hernia would not seriously handicap him. What is true of the operator is also true of the men who do the folding. The helper, however, ought to be able to do his work with the loss of one leg, the loss of two or three fingers on one hand, heart trouble, hernia, certain nervous disorders, stiffness of joints in knee or hip of one leg. Arrangements could be made for this man to be seated at his work most of the time. The wages range from $18 to $22 a week.

Curing. The belts are cured in long presses, some of which are double deckers, accommodating twice the capacity of the single press machines. Some of these presses for curing belts are thirty or forty feet long and fifty inches in width. What has been previously said about the operation of curing applies in this work also.

Inspection of Belts. Inspection of belts is done by two or three men working in a group, an inspector and his helpers. The chief requisite for the inspector is that he shall be thoroughly reliable and possess a fair amount of intelligence and familiarity with the material which passes through his hands. Provided his helpers were able-bodied, it is possible that he could do his work with the loss of a leg below the knee, fingers on one hand, hand or arm below the elbow. Heart trouble, hernia, certain nervous disorders, stiffness of joints in one arm or leg would not be serious handicaps. The work of the helpers is moderately heavy so that with the exception of loss of fingers on one hand the workers should be able-bodied. This work pays from $18 to $22 a week.

Gutta Balata Belting. Certain types of belting differ in character from those described thus far. Among these beltings are gutta balata belts, which are made and folded in a manner similar to that used in the making and folding of the canvas interior of rubber belts. The canvas, before it is folded, is treated with a balata composition. This thoroughly permeates the belting. It is folded at a long table with a heated top. The heat softens the rubber compound so that the surfaces adhere firmly to one another as they are folded together. This form of belting is not cured in an oven, but is allowed to set for a number of days under the pressure of tight winding. The qualifications and wages for making this belting are about the same as those given in the case of the making of other canvas belting.

CONVEYOR BELTING

Conveyor belting is made in a manner somewhat similar to that employed in making transmission belting except that the finished belt is generally much wider than the transmission belting. The center of the belt is usually built up in different piles of duck with a rubber covering outside. The duck, however, is generally not sewed and the entire work is frequently done by one operator instead of breaking up the operations. These belts are cured in presses similar to those employed in the curing of transmission belting. The requirements for building up the belt are similar to those for an operator on the folding table in the making of transmission belting. The wages are also about the same.

PACKING

Packing for valves is made in two general forms, sheet and spiral. Sheet packing is a combination of rubberized fabric built up in various plies. This work is done at benches and involves the cutting and fitting together of the material. The worker should be particularly active with his hands. Loss of fingers or of a leg below the knee, heart trouble, or defective hearing would not disqualify a worker. Two or three weeks would be sufficient time for him to become familiar with his task. The wages are about $20 a week.

Spiral packing is made by winding strips of sheet packing around a mandrel after it has been cured and giving the material an extra cure which is sufficient to set it in spiral form. This work is comparatively light and demands relatively the same physical powers as has been described for making sheet packing. The work could be learned in a week or two. The wages are about $20 a week.

Trimming Ends of Spiral Packing. Where a sufficient amount of spiral packing is made, one man could be kept busy trimming the ends of the packing after it has come from the cure. The work requires no skill and could be done by a man who had lost a leg above or below the knee, fingers on one hand, a hand or arm; heart diseases, hernia, or defective hearing, would also be no serious handicap. The wages are about $18 a week.

ROLL COVERING

In connection with the manufacture of paper, large rubber rolls are used. The rubber on these rolls is built up on a metal center. These rolls vary in size, but average twelve to fifteen inches in diameter and six to eight feet in length. The rubber is built on in plies; no fabric is used in these rolls. The work is moderately heavy so that with the exception of possible loss of leg below the knee, loss of fingers, or defective hearing one should be able-bodied. Two or three months' time is required to gain full familiarity with this work. Wages range from $20 to $25 a week.

Grinding Surfaces on Large Rolls. After the rolls have been built and cured the rubber surface is ground down to exact size and desired smoothness. In performing this operation the roll is placed between centers of a large lathe, the tool of which carries an emery wheel for grinding. As the work of this machine usually involves assisting in handling the roll, the operator should be able-bodied with the exception of loss of fingers on one hand or defective hearing. Wages are about the same as for building rolls.

INSULATING WIRE AND CABLE

Transmission wires for electric current are generally insulated in some way, the relative tension of the current determining the thickness and character of the insulation used.

Tinning Copper Wire. Most copper wire is plated with tin before it is wound for insulation. This is done to prevent deterioration of the copper as a result of contact with the insulating material. The tin plate is put on by running the wire from one roll through a series of vats and rewinding it at the end of the process. In the first two vats the wire passes through a solution containing muriatic acid. This cleans the wire thoroughly. In the third vat the wire passes through molten tin. By means of a cord looped over the wire, all excess of tin is removed from the wire as it leaves the vat. The fourth vat, containing water, cools the wire so that it can be rewound. The operator and his helper must keep constant watch of the process of tinning. This work is not heavy but rerequires constant moving about. The workers must also be able to handle the spools of copper wire as they are placed in the racks and taken down. These spools are quite heavy. Both the operator and his helper should have no more serious handicaps than loss of fingers. The operator requires three or four months experience before he is capable of taking charge of the work. His helper, however, could be trained in two or three weeks. The wages for this work range from $19 to $23 a week.

Rubber Tubing Insulation. After the wire has passed through the tinning process it is treated in a variety of ways according to the purpose for which it is being prepared. In the case of small wires particularly, they are covered with a thin coat of rubber. This work is done in a tubing machine and, in general, is the same as other tubing machine operations. The wire enters the machine at one side and the rubber insulation is molded on as the wire passes through a small die. In winding the insulated wire in large circular pans after leaving the tubing machine, two or three men are sometimes employed to see that the insulation is not disturbed in handling. These helpers do most of their work seated and consequently the loss of one or both legs, loss of fingers on one hand, loss of a hand or arm, stiffness of leg joints, or arm joints in one arm, heart trouble, hernia or defective hearing would not prevent one from doing this work. The wages for the helper range from $18 to $20 a week.

Curing Rubber Insulation. After the insulation has been molded on the wire the large pans in which the wire is received are taken to the curing ovens. Where several of these ovens are operated together it might be possible for a disabled man to take charge of the heats, provided some arrangement could be made so that he would not have to assist in operating the doors of the vulcanizers. Disabilities and wages for this work would be the same as have already been described.

Taping Wire. After the rubber coat has been cured on the wire it is generally wound with friction tape. This work is done on a machine which revolves one or more spools of tape around the wire. In the cases of smaller sizes of wire this winding is done very rapidly. The spools move in their circular course around the wire so rapidly that the eye can scarcely follow them. One or more of these machines are in charge of a single operator. He must be fairly active as he has to handle the spools of wire. Consequently with the exception of the loss of two or three fingers on one hand or defective hearing he should be able-bodied. The work could be learned in two or three weeks. The wages are $20 a week.

Twisting Insulated Wire. Where two insulated wires are used in such work as making telephone connections, they are twisted together. This work is done on a machine which revolves one of the wires about the other at a rapid rate. The operator on this machine would need both hands, arms, and legs, though loss of fingers or defective hearing would not seriously handicap him. The wages are about $20 per week.

Finishing Insulated Wire. Some qualities of insulated wire after they have been wound with cambric are covered with a coat of tar. The tarring is done by drawing the wire through a vat of melted tar. The wire passes through the tar very rapidly so as not to affect the insulation, which has been previously put on. One man has charge of this operation. There is considerable moving about and lifting to do and it is impossible for the worker to keep himself entirely free from the tar. The qualifications are practically the same as those for twisting wire, as the work is fairly heavy. Two or three weeks would be sufficient time to become familiar with the work. The wage is about $20 a week.

Polishing. After the wire has been coated with tar it is sometimes drawn through a polishing rag in order to give it a smooth surface. This work could be done by an operator who is seated, provided some arrangement could be made for handling the spools of wire. The loss of a leg, of two or three fingers on one hand, of an arm or hand, stiffness of joints in one leg or one arm, hernia, certain nervous disorders, or defective hearing, would not prevent one from doing this work. One or two weeks' time would be sufficient to learn the work. The wage is about $18 a week.

Overhauling and Patching Wire. Before insulated wires are sent from the factory they must be tested to ascertain that there are no leaks. In the case of small wires they are run through a vat of water. By means of electrical connections the operator detects any leaks by holding one end of the circuit wire in his mouth. This work can be done seated so that the loss of one or both legs would not prevent one from engaging in this operation. As the worker not only detects the leaks in the insulation, but makes repairs, he would need the use of both hands. Providing arrangements could be made for handling the spools of wire, hernia or stiffness of trunk muscles would not be serious handicaps. The wages are $18 to $20 a week.

Braiding. Two sorts of braid are used in covering copper wire, cotton and metal. Both operations are conducted in a manner similar to braiding in the manufacture of hose. In the case of the wire braid the object is to give strength to the cable. The wire braid is generally used in the large size transmission. In the case of some looms, the loss of a leg below the knee, stiffness of knee joint, loss of two or three fingers on one hand, or defective hearing would not prevent one from doing the work. The wages range from $18 to $25 a week.

Twisting Wires for Cables. In building heavy cables, instead of using one strand of wire a number of strands are twisted together. The twisting is done in a manner somewhat similar to that employed in twisting strands of cotton for making woven hose fabric. The wires pass through small holes in a revolving wheel from spools which are carried on a revolving disk at one end of the machine. The twisted wire is wound on a large spool at the opposite end of the machine. The operator of this machine must be able-bodied with the exception of loss of fingers. The helper, however, who attends to the winding of the cable on the spool could do most of this work seated, as the large spools are turned automatically. Consequently, the loss of a leg would not prove a serious handicap. With a particularly active man the loss of one hand or arm below the elbow or hernia would also not interfere in the operation. The wages of the operator range from $35 to $40 a week. The helper receives from $15 to $18 a week.

Cambric Tape Machine. This machine is used to wind the larger cables with tape. Usually a number of plies are put on at one time. The machine is quite long and accommodates six or eight pairs of winding spools. These spools revolve in pairs around the cable as it passes along the length of the machine. At the same time the cable passes through a stream of tar which coats it. In some machines this operation is combined with that of twisting the cables described under the preceding heading. The qualifications for the operator and helper are practically the same as in the case of twisting. One or two months' experience would be necessary to operate either the twisting or winding machines. The wages are the same for both.

Winding Steel Tape. Where unusual strength is desired in the cable it is sometimes wound with a steel tape as well as with the other coverings already described. The tape is wound much after the fashion of the cambric tape. The requirements and wages for this work are practically the same as that for winding cambric tape.

Leading Cables. In the case of the larger cables a lead covering is placed around the cable proper. This lead cover is molded around the cable in a manner very similar to that employed in molding the rubber insulation in the tubing machine. The lead is fed into the mold from a reservoir above it. The workmen employed in leading should be able-bodied as they must handle lead ingots and do a fair amount of lifting. The operator requires three or four months' training, although his two or three helpers could learn their work in a few days. The wages for the operator are about $25. The helpers receive $19 or $20 a week.

Testing. 'Punching out' is a technical term applied to testing large cables. Where the cables are expected to withstand moisture they are immersed in large tanks for a certain period of time, depending upon the purpose for which they are built. An electric current of specified voltage is then passed through the cable for a definite length of time. In this way any leakage or flaws in the cable are shown. This work requires an able-bodied man as he must be particularly active and any mistakes or mismoves on his part might result seriously. The wages are $20 to $25 a week.

LEATHERETTE

Although rubber does not enter into the composition of the surfacing material in the manufacture of leatherette, this material is being made by mechanical rubber concerns. The process itself is very similar to that of spreading in the manufacture of friction cloth. The basis for the surfacing composition or lacquer is cellulose which is made from celluloid waste and similar material. The lacquer is mixed in large churns for a period of from twenty-eight to forty-eight hours. The work in the mixing room is comparatively heavy and requires an active man, although the loss of fingers or defective hearing would not be a serious handicap. Two or three months' training is necessary to acquire desirable familiarity with the work. Wages are about $20 a week.

Spreading Lacquer. From the mixing room the lacquer is taken to the spreader where it is applied to the surface of the cloth in a manner similar to that employed in rubber spreading. After the fabric has been surfaced it is run through an air chamber where it is dried with the assistance of warm air. The operator of this machine should be fairly active so that with the exception of loss of fingers, or defective hearing there will be no opening for disabled men. The helper on this work should also be fairly able-bodied. The operator could be trained in three or four weeks. The helper could pick his work up in as many days. The wages for the operator are about $27 a week, for the helper about $22.

Graining. Where it is desired to leave a pattern on the leatherette it is placed in a flat press as it comes from the roll. The press is left on the leatherette for a few seconds and then the material is drawn on to a section which has not been in the press. In this way the leatherette is gradually drawn from one roll to another as it passes through the press. The work requires a fairly active man. Loss of fingers or defective hearing would not be serious handicaps. The work could be learned in three or four weeks. The wages are about $20 a week.

Inspecting the Fabric for Knots. This work is similar in character and requirements and pay to that described under inspecting fabric for piece goods.

Inspecting Leatherette. This work in general resembles the inspection of piece goods material and involves the same disabilities. Wages are about $20 a week.

THE FOUNDRY

Some mechanical rubber companies which manufacture a large amount of hose make their own couplings, nozzles, etc. Although this work does not belong strictly to the manufacture of rubber, it is so closely related that a brief description of the operations has been added to the discussion of mechanical rubber.

Core Making. In molding the hollow part of the nozzle or coupling, a sand core is placed in the mold in such a way that the metal, as it is poured, will surround the core. The cores are made by hand by pounding sand into a mold. As all the cores are comparatively small, the work is not heavy. At the present time, some foundries are employing girls. The entire operation can be done seated. The important feature of the work is rapid manipulation of the sand and pounding tools. In one foundry, where men were able to turn out about 700 cores apiece per day, it was found that women could increase the number to a maximum of 1,150 per day. This would tend to show that the work is more desirable for women than for men from the standpoint of the factory. The loss of one or both legs, the loss of one or two fingers on one hand, stiffness of leg joint, or defective hearing would not be serious handicaps in this work. The wages range from $12 to $15 a week.

Mixing Sand for Cores. The sand, of which the cores are made, is mixed with a solution of malt settlings and molasses in order to make it adhere readily. The actual mixing is done in a revolving drum. The work involves the shoveling of sand into this drum and wheeling the sand from one part of the foundry to another. The loss of two or three fingers on one hand, or of a hand or arm below the elbow, or defective hearing would not prove serious handicaps. The wages are about $21 a week.

Core Setting. The mold in which the brass sundries are made is constructed in two parts. The cores are set in the molds after the pattern has been removed from the sand. This work could be done by a man who had lost a leg below the knee, one or two fingers on one hand, the left hand or arm below the elbow. Hernia or defective hearing would also not prove serious handicaps. This work, like the two preceding operations, could be learned in a comparatively short time. The core setter works as a helper to the molder and receives about $20 a week.

Molding. The molder packs the sand around the pattern in the molds. The loss of two or three fingers on one hand, hernia, or defective hearing would not prove serious handicaps in this work. The wages are about $24 a week.

Stock Room. In this room are kept the materials from which the brass is made. The work here is comparatively heavy, as it involves the handling of ingots of brass and copper, so that with the exception of loss of two or three fingers on one hand, or defective hearing, the worker should be able-bodied. The wages are about $22 per week.

Sprue Cutting. When the casting is taken from the mold, small strips of metal remain attached to it. This is caused by the metal collecting in the passages leading through the sand into the mold. These strips are technically called 'sprues' or 'gates'. They are removed on a machine which operates like a punch. Two sharp chisel edges are brought together, thus cutting the sprue away. The machine is operated by a treadle. It is possible that the loss of the left leg would not prevent one from doing this work. With this exception, however, the operator should be able-bodied. The work could be learned in a comparatively short time. The wages are about $22 per week.

Washing Castings. In order to remove the core from the castings and clean them after they are taken from the molds, they are put in tumbling barrels. These barrels are revolved so that the castings are turned around in water and brass chips. The operator sorts the castings as they come from the tumbling barrels. The work involves considerable moving about, so that with the exception of loss of two or three fingers on one hand or defective hearing the worker should be able-bodied. The wages are about $21 a week.

Snagging or Grinding. In order to completely remove protruding parts on the castings, they are ground on emery wheels. The work could probably be done by a man who had lost a leg below the knee. Loss of fingers, or defective hearing, or hernia would also not prove serious handicaps. It is probable that arrangements could be made for the worker to be seated. Two or three months' time is required to gain familiarity and speed in grinding. The wages are about $22 a week.

Inspecting Castings. Before the castings are sent to the finishing department, they are inspected for defects which might arise from faulty molds or cores. In many foundries this work would not take the entire time of one man throughout the year, but it is probable that similar work could be provided for him. The loss of a leg below the knee, the loss of two or three fingers on one hand, hernia, or defective hearing would not prevent one from doing this work. The wages are from $18 to $22.

Pattern Making. A great many of the patterns used in making brass sundries for hose are of metal. Many pattern rooms would offer an opening for a worker who had lost a leg or two or three fingers on one hand. Heart trouble, certain nervous disorders, or defective hearing would also not prevent one from doing this work. The pattern maker receives about $30 a week and should be able-bodied under ordinary circumstances. His helper, who would be gradually learning his duties from the time he entered the pattern shop, would receive about $21 a week.

Summary. Although many foundries are installing fairly effective mechanical devices for drawing off undesirable fumes, this work would nevertheless be unfitted for anyone whose lungs were at all affected. The light in the foundry is apt to be unsatisfactory and the work in general is not as attractive as that in most departments of rubber manufacture.

BRASS FINISHING

Cleaning and Grinding. After the castings have been ground and inspected, they are ready to go to the finishing department. The castings are again ground on an emery wheel to obtain an even surface. Most of this would could be done seated. The loss of one leg above or below the knee, loss of two or three fingers on one hand, stiffness of joints in one leg, hernia, or defective hearing would not prevent one from doing this work. Three or four weeks would be required to gain thorough familiarity with it. The wages are $18 or $20 a week.

Testing Nozzles. Before being attached to the hose, all nozzles are tested under water pressure. This work could be done seated and involves the screwing of the nozzle to a pipe and turning on the water. The loss of a leg, of two or three fingers on one hand, or possible loss of a hand, or arm below the elbow would not prevent one from doing this work. Heart trouble, hernia, certain nervous disorders, or defective hearing would also not prove serious handicaps. The operator will get his clothing wet unless he is careful, so that any one who is apt to be affected with rheumatism or similar troubles should not undertake the work. The wages are about $15 a week.

Plating. The plating of the castings is done in large vats. This work involves a fair amount of lifting, though it is possible that a particularly active man who had lost a leg below the knee could be used. With the exception of loss of fingers or defective hearing, he should be otherwise able-bodied. Although there are few fumes from this process, it would not be advisable for any one to do this work who had any lung difficulties. Two or three weeks' time would be sufficient to gain familiarity with the operation. The wages are about $18 a week.

Lathe Work. There is a considerable amount of lathe work in connection with the finishing of the nozzles. They must be trimmed, reamed, threaded, and drilled according to the requirements of various castings. A lathe could be operated by a man who had lost a leg below the knee. Loss of fingers or hernia would also not be serious handicaps. The loss of fingers, however, should not prevent him from an active use of his hand, as he needs both hands most of the time. The work could be learned in one or two months. The wages are about $19.

Assembling Nozzles. After being drilled and threaded, the parts of the nozzles are assembled. This is bench work and comparatively light. The loss of one or both legs would not prevent one from doing this work, as he could be seated throughout the day. He would, however, have to be particularly active with his hands, so that possible loss of fingers should not interfere with his handling the brass parts. The work can be learned in a few days. The wages are about $15 a week.

MACHINE REPAIR

In the larger rubber plants a machine shop is maintained for repair work. Various operations come into a machine shop, such as lathe work, drilling, and milling. Some of this work could be done by a man with an artificial leg below the knee. Loss of two or three fingers on one hand, hernia, or defective hearing would also not seriously handicap him. His wages would range from $19 to $25 a week according to the amount of previous experience he had had.

TRUCK MEN

Nothing has been said in the discussion of the work of various departments about truck men. In general, the qualifications for this work are the same throughout the single plant. In some plants the moving about of material is done on hand trucks. These trucks must be loaded by hand and pulled from one part of the factory to another. This work is naturally very heavy and requires a man not only in good physical condition, but also of more than average strength.

In some factories, the work of truck men is much lighter than this, because of the introduction of special truck devices. The lifting of material on and off trucks has been done away with to a considerable extent by introducing a truck which will slip under a frame on which the goods have already been piled. By a mechanical device this frame is lifted from the ground. Instead of hand-power trucks, motor-driven trucks are being introduced, so that the exertion of pulling heavily laden trucks about the floors of plants is eliminated. Where such devices are employed, it is possible that arrangements could be made for the operation of a motor truck by a man who had lost a leg below the knee. With the proper device he could also control the levers with the loss of a hand or arm. No great amount of knowledge is involved in the work except familiarity with the department in which the man works. Two or three weeks would be sufficient time to acquire this. The wages range from $19 to $21 a week.

Inspection. In connection with all mechanical rubber departments, careful inspection is made of the finished products. The department inspectors must have a general idea of the processes involved in the making of articles which pass through their hands. They must be able to detect flaws readily and they must be men in whom the head of the department has confidence, so that there will be no danger that unsatisfactory work will be allowed to pass through their hands. In most departments the work of the inspector is not heavy. In some cases the loss of a leg below the knee, the loss of two or three fingers on one hand, hernia, heart trouble, certain nervous disorders, stiffness of the trunk muscles, stiffness of knee muscles in one leg, would not prevent a man from undertaking this work. Two or three months' training and experience would be desirable preparation. The wages usually vary from $20 to $25.

RECEIVING AND SHIPPING

The work in these departments, with the exception of the clerical help, is extremely heavy, as it includes trucking and auto driving. A trucker could do his work with loss of fingers, loss of sight of one eye, or defective hearing. There would be an opening, also, in these departments for a clerk who had lost a hand, but who was capable, and could write with his good hand. The work could be learned in two or three weeks. His wages would be $18 to $20 a week.

Tires

Cutting Stock. Stock for various kinds of tires is prepared in the same general way as stock for hose. The rubber and duck are cut by hand or by machine as in hose making. The physical requirements for these operations would therefore be the same as those previously mentioned. In the case of the fabric the cutting is done in short widths on the bias, as in the case of cutting hose fabric. These strips are pieced together to make a continuous length. This work is similar also to that discussed under the making of hose.

Booking. After the rubber stock has been cut into the desired widths and lengths, it is placed on a frame between pieces of cloth to keep the strips of rubber from adhering to one another. This work is done largely by women. Although the arranging of the strips is very light work, the same operator usually handles the frames or books. The books are not extremely heavy, but are usually carried a short distance to the table where they are placed on racks. The loss of fingers on one hand, heart trouble, hernia, certain nervous disorders, or defective hearing would not prove serious handicaps. Where the carrying of books could be eliminated, the loss of a leg would not prevent one from doing this work. One or two weeks offer sufficient training. The wages vary from $19 to $25 a week.

Assembling Stock on Spools. As a matter of convenience and where casings are built by machine, the rubber and fabric stock for making casings is frequently assembled on spools. The operator who assembles the stock receives it in books. The material is wound in the desired order on the metal spools. The work is comparatively light. Loss of two or three fingers on one hand, loss of a leg below the knee, stiffness of joints in one knee, heart disease, nervous disorders, hernia, or defective hearing would not prevent one from doing this work. The wages vary from $25 to $30. Two weeks would be sufficient time to acquire familiarity with the work.

Making Bicycle Tires. Bicycle tires are built up by hand by combining various plies of rubber and fabric. The work is done on a drum, the diameter of which equals the inside diameter of the tire. The work in general resembles other operations where rubber is built up in plies. At the present time both men and women are engaged in making bicycle tires. The chief requirement is rapid and accurate manipulation. The loss of two or three fingers on one hand, or of one leg below the knee, stiffness of knee joint in one leg, hernia, or defective hearing would not prevent one from doing this work. Stiffness of body or arm muscles would be particularly undesirable. The operator could acquire a fair degree of efficiency in four weeks' time. This work is commonly done on a piece-work basis and at present pays from $20 to $30 a week.

Curing Bicycle Tires. Where bicycle tires are cured in considerable numbers, the presses are arranged in a long row. In front of them are tables where the molds are put over the tires after they have been inflated. The curing presses are cylindrical and are sunk vertically in the floor. They will generally accommodate three or four tires. Each mold is placed between separate plates of the press. This work is very heavy and hot and requires able-bodied men, though the loss of two or three fingers would not be a serious handicap. The operation of tire presses is commonly done on a piece-work basis. Four or five weeks would be sufficient time for a man to learn the work of operating the press. The wages range from $30 to $40 a week.

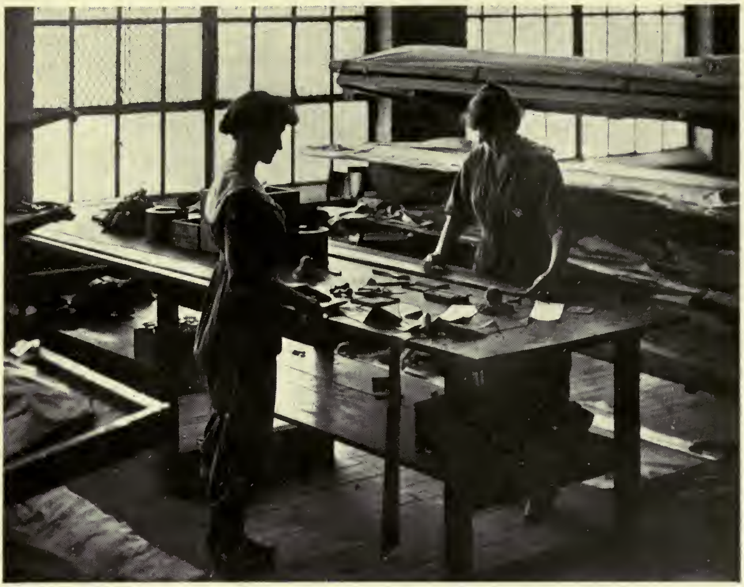
Inspection. In connection with the operation of tire presses, there is frequently a general inspector who sees that the work progresses smoothly. While this work is not heavy, it requires a man who will insist upon a high standard of workmanship. The loss of fingers, of a hand, or of an arm, or stiffness of arm or body muscles, or hernia would not prevent one from doing this work. The wages are from $25 to $30.

Making Tubes. Tubes for automobile tires are commonly made without fabric. The rubber stock is cut into proper widths and lengths and folded over a mandrel. The cutting and making are sometimes done by a single operator working at a long table. Loss of two or three fingers on one hand, hernia, or defective hearing would not prevent him from doing this work. It is possible also that a particularly active man who had lost a leg below the knee could obtain a fair degree of efficiency. From four to six weeks' training would be required to learn the operation of cutting and making. This work pays from $20 to $25 a week.

Curing. The tubes are cured on a mandrel in a manner similar to other processes of curing.

Cementing and Splicing. It has been evident that the tube thus far has been in a single length. In order to form it into the shape of a tire, the two ends, after the tube has been removed from the mandrel, are cemented and spliced. This work at present is being done largely by women. The splicing is accomplished in the most modern method by treating the cemented joint with acid. The work is comparatively light, though it requires very rapid movement of the hands and arms. Loss of two or three fingers on one hand, loss of a leg below the knee, stiffness of one knee joint, hernia, or defective hearing would not prevent one from doing this work. Wages are about $20 a week.

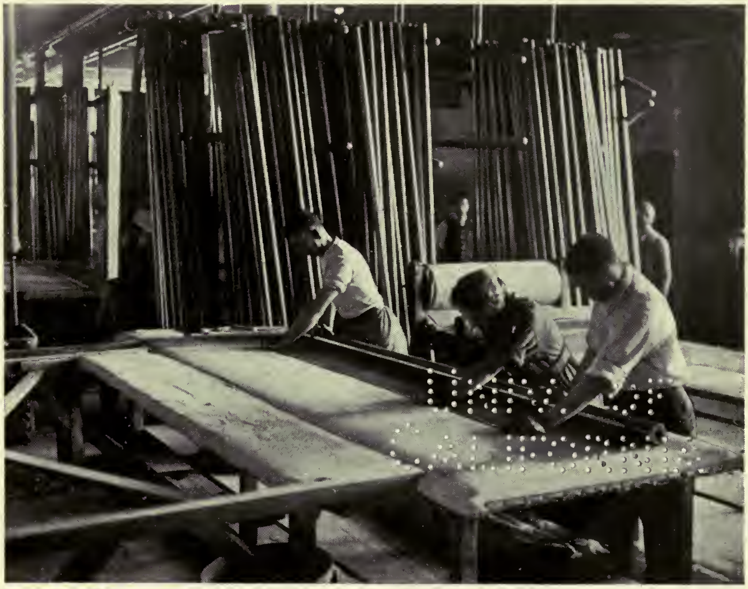
Putting in Valve. After the ends of the tube have been joined the valves are put in. This work also requires very rapid use of hands and arms. Women at the present time



Courtesy, Fisk Rubber Co., Chicopee Falls, Mass.

Making treads by hand

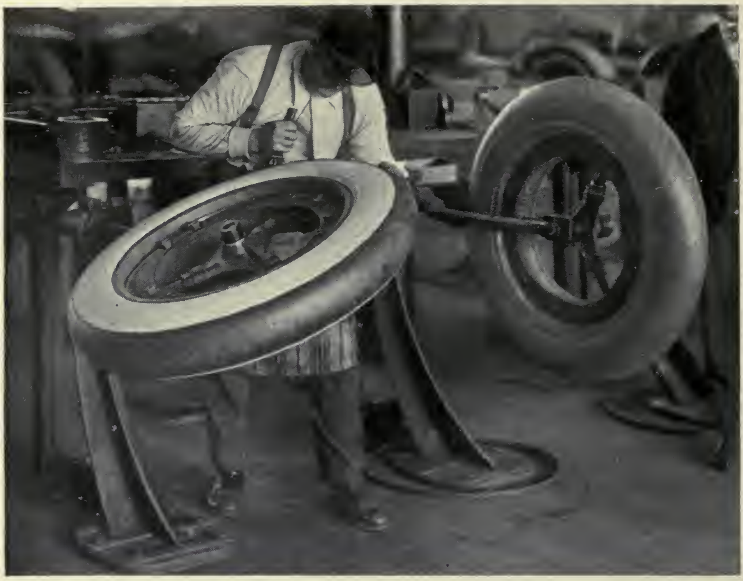
Behind each worker are books containing duck and rubber from which the tread is built up on the table



Courtesy, Fisk Rubber Co., Chicopee Falls, Mass.

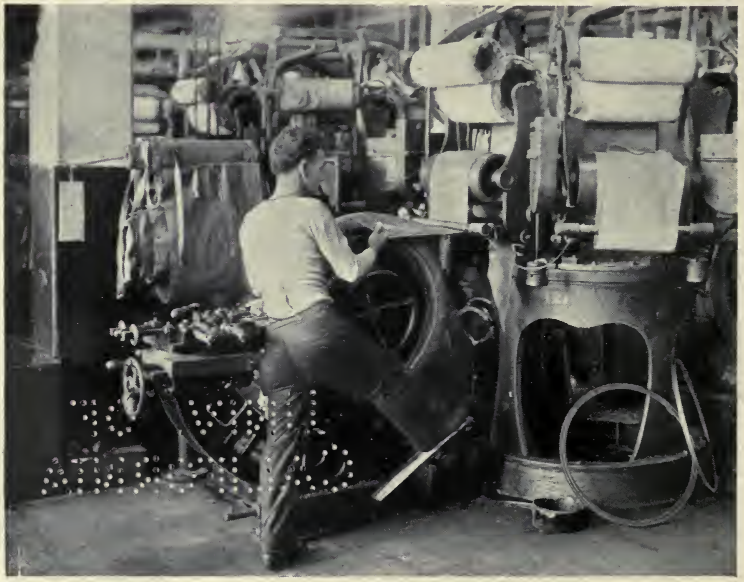
Making inner tubes

The rubber stock is rolled on mandrels prior to curing



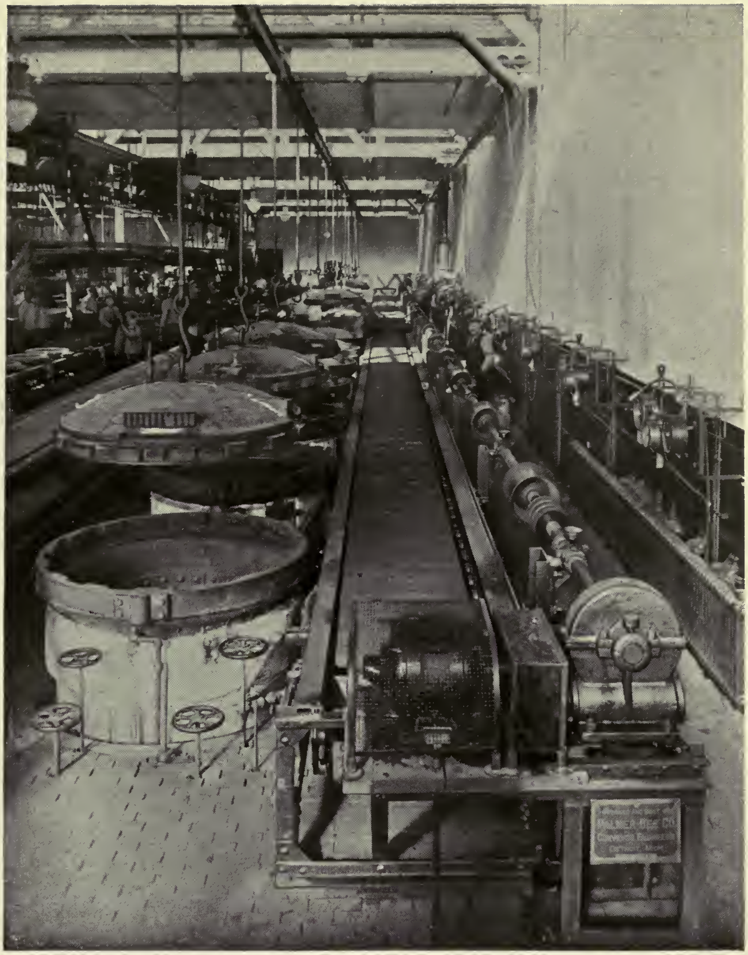
Courtesy, Fisk Rubber Co., Chicopee Falls, Mass. *Making casings by hand*

Hand tools are used in rolling the layers of rubberized fabric and rubber strips about the core which gives form to the tire



Courtesy, Fisk Rubber Co., Chicopee Falls, Mass. *Machine method of making casings*

One of the wheels for folding the material around the mold can be seen under the worker's right elbow. The stock is wound on the mold easily as the latter revolves



Courtesy, Fisk Rubber Co., Chicopee Falls, Mass.

Vulcanizing room for tire casings

Chain and belt conveyors are used for handling the heavy molds which fit into the cylindrical ovens

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are generally employed for this operation. The work is done at a bench, so that loss of a leg below the knee or stiffness of the knee joint in one leg would not seriously handicap the worker. Loss of two or three fingers on one hand, hernia, or defective hearing would also not disqualify one. Two weeks' training would be sufficient time for learning the operation and acquiring a fair degree of efficiency. The wages range from $20 to $25 a week.

Winding Cord Tires. In the heavier casings for automobile tires, a cord base is built up in order to give added strength to the tire. This cord is wound automatically at an angle of forty-five degrees to the circumference of the tire. The casing mold is placed vertically in a machine where a mechanical device passes the cord around the mold. At the same time the mold is revolved slowly, so that the cord forms a solid cover to the mold at the completion of each winding process. The cord is usually put on in two plies, the second ply crossing the first ply at right angles. Between the plies is a covering of friction duck. One operator cares for a number of these winding machines. He should be fairly able-bodied, as the work involves the handling of the metal molds. The loss of fingers or defective hearing would not be serious handicaps. From a month to six weeks' time is required to gain desirable familiarity with the work. The wages are from $25 to $35 a week.

Rubberizing Tire Cord. The cord which is wound on the casing to form the cord tire is first wound on large spools. In the process of winding, the cord passes through a rubber solution and from that to a long curing box where the solution is vulcanized into the cord. In this way the cord is rubberized by the time it reaches the winding spool. One operator has charge of a number of these machines and must in general be active with his hands and legs. Loss of one or two fingers or defective hearing would not seriously handicap him. The work could be learned in three or four weeks' time. The wages range from $25 to $30 a week.

Building Tire Casings (*Hand*). In the case of cord tires, as well as those which are not wound, the different plies of the casing are put on either by hand or by machinery. The work in both cases is comparatively heavy, as it involves the handling of the molds on which the casing is built. The work of building up the plies by hand is similar in principle to that involved in the making of bicycle tires. The entire operation of building the casing is carried on by one person. At the present time most of the work is being done by men, though in some cases women are proving successful when properly selected. The work itself, besides being heavy, requires rapid movement of hands and arms. In most factories the material is so placed as to eliminate almost entirely movement about the floor, though the work could not be done seated. The loss of two or three fingers on one hand or defective hearing are about the only disabilities which would not disqualify the worker. From four to six weeks are required to gain a desirable degree of proficiency in making casings. The wages range from $20 to $35 a week.

Building Tire Casings (*Machine*). When the plies of casings are built up by machine, two or three of the inside plies are usually rolled on the mold by hand before it goes to the machine. At the machine the rubber and duck plies are hung on spools. The casing mold is arranged so as to revolve in a vertical plane. The operator fixes the end of the ply to the mold and revolves it. When the mold has been covered for its entire circumference, a mechanical device consisting of two disks folds back the material over the surface of the casing. The requirements and wages for this work are practically the same as those for hand building.

Making Treads and Beads. Hand-made treads are built up from plies of duck and rubber much as casings are built, except that the work is laid out flat on a table. The disabilities and training are the same as for building bicycle tires. The salary is from $20 to $25 per week. Heavy tire treads are commonly made on a machine similar in its general construction to a tubing machine. In some machines the tread, as it comes through the die, is in the form of a tube. Just as it leaves the machine, there is a slitting knife which opens the tube and the tread comes out flat. This machine, which is somewhat larger than the ordinary tubing machine, requires one operator, one or two men to feed it, and two or three helpers who cut the tread in desired lengths and place it in books. Beads are made on a similar machine. The operator of a tread machine could do his work with the loss of a leg below the knee, stiffness of joints in one knee, hernia, or defective hearing. It is possible that where there are two feeders and two or three helpers, one feeder and one helper might have the same disabilities. The time required to learn the work on this machine is practically the same as for tubing machines. Wages range from $25 to $35 a week.

Curing Treads. In some factories treads are semi-cured before they are put on the casings, while in others the treads and casings are cured together after the tire has been made. In the case of semi-curing treads, the tread is placed on a metal drum which carries the negative of the impression desired in the tread. The semi-curing is done in a curing oven similar to that used for curing tires. The requirements and wages are practically the same.

Making Cord Tire Water Bags. In the curing of cord casings the casing is filled with a water bag similar in construction to the inner tube. This bag is filled with water so that the desired amount of expansion is obtained during the curing processes. The water bags are built on mandrels in a manner similar to that employed in the building of tubes. They have, however, a rubber center and several plies of duck over it. The work involves rapid use of the hands and arms. At the present time both men and women are engaged in this operation. If arrangements could be made for placing the stock at the worker's table so that he would not have to walk to racks for it, the work could be done by a man who had lost a leg below the knee or whose knee joints were stiff. The loss of one or two fingers, hernia, or defective hearing would also not seriously handicap the worker. From two to three weeks' time would be sufficient for gaining necessary familiarity with the work. The wages vary from $25 to $35 a week.

Making Cord Tire Water Bags. (*Minor Operations.*) In connection with the making of water bags there are a number of minor operations. One of these is the making of the water bag flap which goes around the water bag and fastens into the mold. It is made of friction duck. The physical requirements are practically the same as those for making the water bags. The wages vary from $20 to $25 a week. Before the flaps are placed in the casings they are painted. This is done by hand with a brush. The requirements here are about the same as those previously mentioned for making the flaps. The wages are about $20 a week. Two or three weeks would be sufficient time for acquiring familiarity with the minor operations in building water bags.

Curing Casings. Where the tread is semi-cured before putting it on the casing, the casing is also semi-cured. Instead of putting the casing into an outside mold, it is frequently wound with duck while in the inside mold. This work is done by machinery which revolves the tire and at the same time winds it. The work is comparatively heavy, as it involves the handling of the casing and mold so that the operator should be able-bodied with the exception of defective hearing or loss of two or three fingers on one hand. The wages are $20 to $25 a week. Where the casing and tread are cured together they are placed between an inner and an outer mold. Most of the operations in the curing of casings involve heavy work. In the larger curing rooms the vulcanizers are arranged in rows and are conveniently near various mechanical devices which assist in handling the molds. With the assistance of endless chain and belt devices, the lifting and moving about of the molds by hand can be practically eliminated. However, even with the assistance of mechanical devices the men require all their physical powers. The work is hot and heavy. One operation, however, in this department could be carried on by a man with certain disabilities by standardizing the work. The heats in the various curing chambers could be placed in charge of one operator. The loss of a hand or arm below the elbow, the loss of a leg below the knee, stiffness of elbow or shoulder joints in one arm, the loss of fingers, or hernia would not be serious handicaps in this work. The wages are about $25 a week.

Cleaning and Inspecting. The rough edges must be taken off tire casings before they are ready to be sent from the plant. This is done at a buffing wheel. The work is comparatively heavy. Loss of a leg below the knee, or of two or three fingers on one hand, or defective hearing would not seriously handicap the worker. The wages range from $20 to $25 a week.

Wrapping Casings. Anyone who is familiar with automobile tires as they pass through the hands of the retailer, knows that they are wrapped with paper which comes in long strips and is wound in a spiral around the casing. The mechanical device, by which this wrapping is put on, is very similar to that by which the cord is put on cord tires. The operator could do this work with the loss of two or three fingers on one hand, stiffness of joints in one knee, or defective hearing. One or two weeks' experience is sufficient to learn the work. The wages range from $20 to $30 a week.

Making Solid Tires. Solid tires are made of rubber which is wound around a metal frame parallel to the circumference. In some cases the rubber is wound directly from the calender and thus eliminates the work of rehandling. The operator must handle the completed tire, so that his work is comparatively heavy. With the exception of loss of two or three fingers on one hand, or defective hearing, the worker should be able-bodied. Five or six weeks are sufficient to gain familiarity with the work. Wages are about $25 a week.

Another method for making solid tires which will probably gain popularity involves the use of a machine similar to that employed in making treads. The rubber portion of the tire is turned out complete in strips which then are placed on a drum and cured.

TIRE REPAIR

Defective tubes and casings are repaired wherever possible. This work is done at benches and consists of removing the defect and putting in a patch. As some of the casings are heavy, the workman should be able-bodied, unless arrangements could be made for one or two men to repair the lighter casings and tubes. In this case, the loss of a leg below the knee, the loss of two or three fingers, or defective hearing would not be serious handicaps. The work could be learned in a month or six weeks. Wages are $18 or $20 a week.

TIRE SUNDRIES

Making Emergency Patches. This work consists of cutting and putting together in various plies friction duck and rubber. The work is done at tables, one operator doing the cutting and piecing together. Girls usually do this work. Arrangements could be made for a man who had lost a leg to sit for the entire operation. Loss of two or three fingers on one hand, heart trouble, hernia, or stiffness of leg joints, or defective hearing would not seriously handicap him. The work could be learned in a week or two. The wages are about $18 or $19 a week.

Curing Patches and Other Sundries. Patches are cured in press molds arranged in a series of ten or a dozen molds to a press. The work is similar to other press work and the operator ought to be able-bodied with the exception of loss of two or three fingers or defective hearing. The wages range from $20 to $25 a week. There are other curing operations of a somewhat lighter character in connection with the vulcanizing other tire accessories.

Boxing. Patches and tire accessories are commonly put up in cardboard boxes. This work involves rapid movement of the hands and arms and, in general, resembles the boxing of larger rubbers previously described.

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